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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned-public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

MAP SHOWING POTENTIAL GEOTHERMAL-RESOURCE AREAS, AS INDICATED BY THE CHEMICAL CHARACTER OF GROUNDWATER IN VERDE VALLEY, YAVAPAI COUNTY, ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
P. P. Ross, and C. D. Farrar.
Geological Survey Water Resources Investigations 80-13 (open-file report), January 1980. 1 Sheet, 17 Ref.

Descriptors: *Maps, *Geothermal studies, *Geochemistry, *Groundwater, *Arizona, Geology, Thermal water, Hot springs, Wells, Sampling, Thermometers, Water temperature, Mineral water, Chemical analysis, *Verde Valley(Ariz), *Yavapai County(Ariz).

Verde Valley--an area of complex geology where the crust of the North American plate changes from unstable to stable--is in central Arizona in the transition zone between the Basin and Range and the Colorado Plateaus tectonic provinces. Volcanism and tectonism have been progressing northeastward along the transition zone for about 20 million years. The Verde Hot Springs area is the focal point of the intersection of three major lineaments. More than 100 water samples were collected from wells and springs in the valley, and temperatures of the potential geothermal resources were calculated using two geochemical methods or geothermometers--silica and Na-K-Ca geothermometers. Because of the high concentration of dissolved magnesium in the ground water, the silica geotemperatures are considered to be more reliable than the Na-K-Ca geotemperatures. The Camp Verde and Verde Hot Springs areas contain ground water that has quartz-silica geotemperatures of between 99 and 135C and chalcedony-silica geotemperatures of between 73 and 111C. The geochemical evidence to substantiate a geothermal resource in Verde Valley is not conclusive, and further work including test drilling, should be done to verify the silica geotemperatures given in the map. (Kosco-USGS)
W80-05456

HYDROLOGY AND GEOCHEMISTRY OF THERMAL SPRINGS OF THE APPALACHIANS,
Geological Survey, Morgantown, WV. Water Resources Div.
W. A. Hobba, Jr., D. W. Fisher, F. J. Pearson, and J. C. Chemerys.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Geological Survey Professional Paper 1044-E, 1979. 36 p, 22 Fig, 5 Tab, 47 Ref.

Descriptors: *Hydrology, *Geochemistry, *Thermal springs, *Appalachian Mountain Region, *Structural geology, Groundwater, Water circulation, Water quality, Chemical analysis, Radioisotopes, Stable isotopes, Gases, Hydrogeology, Hydrologic data, *Eastern United States, *Valley and Ridge physiographic province.

Nearly all of the thermal springs in the eastern United States occur in the Valley and Ridge physiographic province. Ten large springs in the area from New York to Georgia were selected for study. All of the springs studied discharge from folded and faulted sandstone or carbonate rocks in valley areas. Ground water is believed to circulate to great depths roughly parallel to strike with rapid upward migration to a spring where deep vertical faults or fractures cross the bedding and increase rock permeability. Hydrologic and geochemical data suggest that the water discharging at some warm springs in the Devonian Oriskany Sandstone is derived principally from recharge entering and circulating through that formation. Chemical quality and radioisotopes indicate that most of the springs discharge a mixture of cool shallow-circulating water and warm deep-circulating water. Geochemical thermometers indicate maximum water temperatures at depth range from a low of 34C at Minnehaha Springs, West Virginia to a high of 84C at Hot Springs, North Carolina. The chemical and hydrologic data indicate the thermal springs derive their heat at depth from 'normal' geothermal heat flow. (Kosco-USGS)
W80-05457

1B. Aqueous Solutions and Suspensions

ELECTRICAL RESISTIVITY OF GEOTHERMAL BRINES,
H. Ucok, I. Ershaghi, and G. R. Olhoeft.
Journal of Petroleum Technology, Vol 32, No 4, p 717-727, April, 1980. 14 Fig, 8 Tab, 26 Ref, 1 Append.

Descriptors: *Resistivity, *Brines, *Geothermal studies, Temperature, Salinity, Salts, Chlorides, Computer models, Regression analysis.

Interpretation of electrical measurements in geothermal areas is subject to errors greater than 25% since it is based on extrapolation of lower temperature and concentration data. Furthermore, different salts have widely varying temperatures and concentration dependencies in the geothermal range, which complicates the reduction of a mixed salt solution to an equivalent NaCl solution. This paper presents new experimental data and an improved descriptive model of the electrical resistivities of brines composed of chlorides of sodium, potassium, and calcium. Measurements of temperatures from 22 to 375C and concentration from 3 to 26 wt % under a hydrostatic pressure of 31 M Pa were fitted by three-dimensional regression analysis to an accuracy of + or - 2%. New temperature and concentration - dependent NaCl equivalent multipliers have been generated for potassium and calcium. A graph showing resistivity of NaCl aqueous solutions as a function of temperature and concentration is presented as a more accurate replacement for existing graphs based on extrapolated data. (Purdin-NWWA)
W80-05542

2. WATER CYCLE

2A. General

WATER RENEWAL EFFICIENCY OF WATERSHED AND LAKE COMBINATIONS IN THE ELA REGION OF THE PRECAMBRIAN SHIELD,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
R. W. Newbury, and K. G. Beaty.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 335-341, March 1980. 3 Fig, 3 Tab, 13 Ref.

Descriptors: *Watersheds(Basins), *Lakes, *Water balance, *Canada, *Model studies, Mathematical models, On-site investigations, On-site data collections, Runoff, Precipitation(Atmospheric), Evaporation, Evapotranspiration, Mass transfer, Water temperature, Hydrology, Watershed hydrology, Watershed efficiency, Water renewal.

Individual components of lakewater budgets in the Experimental Lakes Area (ELA) are highly variable through time. Direct field measurements combined with empirical relationships for unmeasurable components are required to achieve balanced lakewater budgets over short intervals of several hours or days. However, annual variations in the hydrological regime are related to a few simple characteristics of the lake and surrounding watershed. In the 1969-77 period the annual ratios of terrestrial evapotranspiration/precipitation and lake evaporation/precipitation showed little variation and were of a similar magnitude. As a result, the potential for water renewal or replacement in the lake basins annually can be characterized by only four factors: the annual precipitation, the tributary drainage basin area, the lake area, and the lake volume. The potential has been expressed as the Annual Watershed Efficiency (AWE), the reciprocal of the water renewal time, to obtain a linear relationship between the four variables. The AWE is a measure of the extent to which a particular watershed and lake combination can renew the lake water under various annual precipitation conditions. A general graphical relationship for the AWE was prepared for small headwater lakes similar to those of the ELA for a range of annual precipitations. (Sims-ISWS)
W80-05420

IN SITU MEASUREMENTS OF PORE WATER DIFFUSION COEFFICIENTS USING TRITIATED WATER,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2F.
W80-05424

SIMULATION OF INTERMITTENT HYDROLOGICAL PROCESSES BY INHOMOGENOUS ALTERNATING MODELS (LA SIMULATION DES PROCESSUS HYDROLOGIQUES INTERMITTENTS PAR DES MODELES ALTERNES INHOMOGENES),
Ecole Polytechnique Federale de Lausanne (Switzerland). Lab. d'hydraulique.
M. North.
Hydrological Sciences Bulletin, Vol 25, No 1, p 5-12, March 1980. 8 Fig, 8 Ref.

Descriptors: *Model studies, *Hydrologic properties, *Stochastic processes, *Statistical methods, Mathematical models, Analysis, Analytical techniques, Probability, Time series analysis, Hydrology, Hydrologic systems, Intermittent processes.

Current techniques for separating the periodic and stochastic components of time series cannot be applied to intermittent processes. It was shown that the cyclic trend can nevertheless be included in an inhomogeneous alternating model. Estimation of its parameters was made by the maximum likelihood method. (Humphreys-ISWS)
W80-05436

URBAN STORM-RUNOFF MODELING--MADISON, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
R. S. Grant, and G. Goddard.
Available from: OFSS Bx 25425, Fed. Ctr. Denver, CO, 80225, Paper copy $4.25, Microfiche $3.50. Geological Survey open-file report 79-1273 (WRI), November 1979. 29 p, 11 Fig, 14 Tab, 10 Ref.

Descriptors: *Urban runoff, *Storm runoff, *Urban hydrology, *Computer models, *Wisconsin, Storm drains, Infiltration, Peak discharge, Water quality, Water treatment, Water management(Applied), Watersheds(Basins), Water storage, Chemical analysis, Water analysis, Hydrologic data, Evaluation, *Madison(Wis), *Illinois Urban Drainage Area Simulator(ILLUDAS).

Four urban basins in Madison, Wisconsin, have been modeled to determine the effects that (1) physical changes to storm-sewer conduits, and (2) increased runoff detention and infiltration would have on peak discharge and runoff volume attenuation. Various storm-water-management options were simulated using the Illinois Urban Drainage Area Simulator (ILLUDAS). A brief evaluation was made of a modified version of ILLUDAS that simulates quality of urban runoff. Some notable simulation results were that a 25 percent storm-sewer slope reduction yielded only a 3 percent peak-discharge reduction, and increasing storm-sewer roughness by increasing Manning's n from 0.013 to 0.040 decreased peak discharge about 10 to 20 percent. Detention of 10 percent of runoff throughout each basin also reduced peak discharge about 10 to 20 percent. Infiltration of all parking-lot runoff reduced peak discharges 5 to 24 percent. Peak discharges were reducted 71 to 88 percent by substituting porous pavement for conventional pavement. Draining 90 percent of the residential

rooftops onto lawns instead of driveways reduced peak discharge from 7 to 31 percent. Runoff-volume reduction was similarly reduced for the induced infiltration simulations. Storage requirements for hypothetical storm-water-treatment plants ranged from 2.6 to 29 acre-feet for the smallest and largest basins, respectively, with a treatment capacity of 25 cubic feet per second. A brief evaluation to simulate storm-runoff quality resulted in the model computing loads 7 to 11 times greater than observed loads for ammonia nitrogen and orthophosphate. The ratio of simulated to observed loads for nitrates, organic nitrogen, total phosphate, and total solids ranged from 0.50 to 1.8. Observed loads are doubtful because of the sparsity of water-quality data. (Kosco-USGS)
W80-05442

STORM WATER MANAGEMENT MODEL VERIFICATION STUDY.
Dillon (M. M.) Ltd, Toronto (Ontario).
Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 97. (1979) 117 p, 18 Fig, 19 Tab, 3 Append.

Descriptors: *Combined sewers, *Storm water, *Urban runoff, *Model studies, Simulation analysis, Canada, Urban drainage, Surface runoff, Drainage systems, Hydrologic data, Hydrographs, Storms, Water quality, Water management(Applied).

Data from 20 well-defined storm events in Toronto, Canada, were used to calibrate and verify the US Environmental Protection Agency's Storm Water Management Model (SWMM), both quantitatively and qualitatively. The area used is served by combined sewers and is predominantly residential (89.1%), most single-family units. The general surface slopes gently from an elevation of 436.5 ft to a low elevation of 388.5 ft. Approximately 49% of the 383 acre area is impervious to runoff. Factors such as street cleaning, sewer cleaning, and snow and ice control were considered. A data acquisition system was used to measure precipitation, air temperature, and the quality and quantity of runoff to produce precipitation hyetographs, air temperature graphs, storm hydrographs, and pollutographs. Quantity verification results were good, with simulated flow volumes underestimated by about 3%. Quality verification results were reasonable and could probably be improved through intensive recalibration. The good verification results are attributed to: (1) the well-defined catchment area with accurate physical characteristic determinations, (2) the detailed area and sewer division scheme used, and (3) the quality and completeness of data. Compared to other similar studies, the SWMM simulations were good for both runoff flow and water quality. (Seigler-IPA)
W80-05565

2B. Precipitation

ATMOSPHERIC LONG RANGE TRANSPORT OF LEAD TO DENMARK,
Copenhagen Univ. (Denmark). Inst. of Plant Ecology.
M. F. Hovmand.
Tellus, Vol 32, No 1, p 42-47, February 1980. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Lead, *Air pollution, *Precipitation(Atmospheric), *Fallout, Rainfall, Pollutants, Sampling, Foreign research, Chemical analysis, Analysis, Data collections, Aerosols, Analytical techniques, On-site investigations, *Denmark.

Lead in bulk precipitation (rainwater + dustfall) was measured in 42 randomly taken, 24-hour samples from Keldsnor, Langeland, Denmark. Trajectories were computed to find the origin of the rain-bearing air masses. It was shown that the mean lead concentrations of bulk precipitation in cases with air trajectories from Central Europe, England, and the Atlantic, respectively, were significantly different at the 0.1% level. From the amount of precipitation and the frequency of transport events, it was estimated that about two-thirds of the lead deposition in the rural environment of Denmark more than 100 m from roads was transported from long range. (Humphreys-ISWS)
W80-05482

A STUDY OF THE CHEMICAL COMPONENTS OF AEROSOLS AND SNOW IN THE KASHMIR REGION,
Institute of Tropical Meteorology, Poona (India).
R. K. Kapoor, and S. K. Paul.
Tellus, Vol 32, No 1, p 33-41, February 1980. 5 Tab, 20 Ref.

Descriptors: *Snow, *Aerosols, *Nucleation, *Chemical analysis, Cloud physics, Sampling, Chlorides, Sodium, Sulfates, Nitrates, Potassium, Calcium, Ammonia, Data collections, On-site investigations, Cations, Foreign research, Analysis, *India.

Atmospheric aerosols in surface air were sampled for a total period of 2 weeks, from February 25 to March 11, 1971, during the winter season, at Gulmarg and Srinagar. Snow samples were also collected on days of snow occurrence during the period. Aerosols were sampled using cascade impactor and millipore filter assembly. Samples collected through impactor were categorized into hydroscopic and nonhygroscopic nuclei, while chloride, ice-forming, and total nuclei were evaluated from millipore filters. Analysis of the aerosol data showed higher counts for all the nuclei at Srinagar with respect to Gulmarg. Fractions of chloride, hydroscopic, and ice-forming nuclei among the total nuclei were larger at Gulmarg. Aerosol counts during the days were higher as compared to the corresponding night values. All the chemical constituents, except Cl(-), gradually reduced from the initial to the end stage of the snowfall. Snow sample from Srinagar indicated higher cation concentrations. Variations of aerosols under different weather conditions were discussed. (Humphreys-ISWS)
W80-05483

ANNUAL R VALUES IN NORTH MISSISSIPPI,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
K. C. McGregor, C. K. Mutchler, and A. J. Bowie.
Journal of Soil and Water Conservation, Vol 35, No 2, p 81-84, March-April 1980. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Rainfall, *Kinetics, Mississippi, Soil erosion, Watersheds(Basins), Erosion, Rain gages, Precipitation(Atmospheric), *Rainfall factor, *Pigeon Roost Creek, *Laboratory Creek, Annual R values, Soil loss equation, Raindrop size distribution, Erosion index.

Rainfall factor values derived from rainfall records in two north Mississippi watersheds proved to be significantly higher than values previously suggested for use in the universal soil loss equation. This analysis of rainfall erosivity involved a 19-year period in the Pigeon Roost Creek watershed, a 117-square-mile watershed near Holly Springs, and a 16-year period in the Laboratory Creek watershed, a 1.6-square-mile watershed that includes part of Oxford. The study supported use of the Wischmeier-Smith equation for computing R values in regions of high rainfall. Average annual values computed with the equation are considerably higher than their published R factors for this region. Records less than 20 years may be biased by short-run deviations from normal rainfall, but average annual rainfall amounts were near normal, and the period of record for the Pigeon Roost Creek watershed was only 1 year short of 20. (Roberts-ISWS)
W80-05636

2C. Snow, Ice, and Frost

OPERATIONAL AERIAL SNOW SURVEYING IN THE UNITED STATES,
National Weather Service, Silver Spring, MD.
E. L. Peck, T. R. Carroll, and S. C. Vandemark.
Hydrological Sciences Bulletin, Vol 25, No 1, p 51-62, March 1980. 4 Fig, 2 Tab, 22 Ref.

Descriptors: *Snow, *Gamma rays, *Snow surveys, Snow cover, Snowpacks, Operations, Aircraft, Radiation, Water equivalent, On-site tests, *Aerial snow surveying, *Operational surveys, Airborne data acquisition, Gamma radiation detector, Data acquisition, Gross gamma flux, Cosmic background radiation.

An airborne gamma radiation detector and data acquisition system was designed for rapid measurement of the snow cover water equivalent over large open areas. Research and field tests conducted prior to the implementation of an operational snow measurement system in the United States were reviewed. Extensive research test flights were conducted over large river basins of the north-central plains and in the high mountain valleys of the intermountain West. Problems encountered during development included: (1) error in the gross gamma flux produced by atmospheric radon gas daughters, (2) spatial and temporal variability in soil moisture, and (3) errors in gamma radiation count rate introduced by aircraft and cosmic background radiation. Network design of operational flight line and ground observation data used in a river forecasting system were discussed. (Roberts-ISWS)
W80-05435

AERIAL GAMMA SURVEY OF SNOW COVER AND SOIL MOISTURE,
Gosgimet, Moscow (USSR).
For primary bibliographic entry see Field 7B.
W80-05494

PRINCIPLE AND METHOD FOR MEASUREMENT OF SNOW WATER EQUIVALENT BY DETECTION OF NATURAL GAMMA RADIATION,
Institute for Atomenergi, Kjeller (Norway).
For primary bibliographic entry see Field 7B.
W80-05495

AIRCRAFT GAMMA-RAY SPECTROMETRY IN SNOW WATER EQUIVALENT MEASUREMENT,
National Water Board of Finland, Helsinki.
For primary bibliographic entry see Field 7B.
W80-05496

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA,
Cold Regions Research and Engineering Lab., Hanover, NH.
P. V. Sellmann, E. Chamberlain, S. Arcone, S. Blouin, and A. Delaney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 93-115, October 1979. 13 Fig, 19 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-01-5-022-2313.

Descriptors: *Permafrost, *Hazards, *Soil mechanics, Exploration, Environmental effects, Water pollution sources, Resources development, Alaska, Cold regions, *Outer Continental Shelf, Petroleum development, Beaufort Sea, Prudhoe Bay.

The objective of the subsea permafrost program is to obtain information on the distribution and properties of permafrost beneath the Beaufort Sea. Information is currently being acquired on the distribution of ice-bonded permafrost from analysis of the velocity structure of commercial seismic records. This report summarizes the results of all studies to date, including engineering property analysis and preliminary interpretation of seismic data. Emphasis is placed on results that are relevant to offshore development of this region. Discussion of the drilling and laboratory program represents the most current interpretation of these data. The variability of the offshore permafrost,

and uncertainties concerning some of its critical properties, such as ice volume, will require future development activities to be accompanied by detailed site-specific investigations. This is particularly true since there has been little experience with a thermal and physical setting such as this. (Sinha-OEIS)
W80-05584

OFFSHORE PERMAFROST STUDIES AND SHORELINE HISTORY OF CHUKCHI AND BEAUFORT SEAS AS AN AID TO PREDICTING OFFSHORE PERMAFROST CONDITIONS,
Geological Survey, Menlo Park, CA.
P. A. Smith, and D. M. Hopkins.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 116-163, October 1979. 2 Ref, 5 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Permafrost, *Hazards, Exploration, Environmental effects, Water pollution sources, Resources development, Oil wells, Alaska, Cold regions, Boreholes, *Outer Continental Shelf, Petroleum development, Beaufort Sea, Chukchi Sea.

The main objectives are to determine the extent of offshore permafrost on the Beaufort Sea shelf and to explore the relationship of coastal geology and geomorphology to shoreline history and offshore permafrost. Toward this purpose, results from seven boreholes drilled in Prudhoe Bay during 1976 and 1977 have been analyzed and attempts to correlate lithologic, paleontologic and permafrost characteristics of borehole sediments have been made. Ice-bonded permafrost on the Beaufort Sea shelf in the Prudhoe Bay region is deeply thawed in what is interpreted as paleovalleys excavated by the major rivers on the coast during the last low sea-level interval. It may be possible to predict the distribution of areas of deeply thawed ice-bonded permafrost elsewhere on the shelf by establishing the paleo-drainage pattern. Methods for predicting the depth and distribution of permafrost on the shelf is valuable in setting up guidelines for the siting of offshore oil and gas wells, while determination of shoreline history, storm-surge limits and coastal erosion rates on the Beaufort Sea shelf aid in planning the location of onshore support facilities necessary for oil and gas production. (Sinha-OEIS)
W80-05585

MARINE ENVIRONMENTAL PROBLEMS IN THE ICE COVERED BEAUFORT SEA SHELF AND COASTAL REGIONS,
Geological Survey, Menlo Park, CA. Branch of Pacific-Arctic Marine Geology.
P. Barnes, and E. Reimnitz.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 164-267, October 1979. 3 Fig, 32 Ref, 5 Attachments. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sea ice, *Ice cover, *Hazards, *Permafrost, Construction, Drilling, Resources development, Environmental effects, Water pollution sources, Alaska, Cold regions, Coasts, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

The present investigation is an expansion and intensification of earlier studies on the marine geology and modern sedimentary environment of arctic Alaska with emphasis on rates and processes; in particular phenomena involving ice and its unique influence on the shelf and inshore environment. The marine environment of the arctic shelf poses special problems to offshore development. The interaction of the arctic shelf with the arctic pack ice takes the form of ice gouging and the formation of a large stamukhi zone each winter. Oil drilling and production during the next several years will probably not extend into the stamukhi zone seaward of the seasonal fast-ice zone. Of critical concern are the ice gouge and strudel scour effects on structures and pipelines. Any structure which is to be mated with the ocean floor requires data concerning the strength and character of the ocean floor. Furthermore, foundation materials in the form of gravels will be needed for work pads offshore. In addition, the offshore drilling operation may encounter permafrost and associated gas hydrates which could be substantially altered during the process of pumping hot oil up to the sea floor or along the sea floor in gathering and transportation pipelines potentially causing structural failure and blowouts. (Sinha-OEIS)
W80-05586

YUKON DELTA COASTAL PROCESSES STUDY,
Houston Univ., TX. Dept. of Geology.
W. R. Dupre.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 268-323, October 1979. 2 Fig, 44 Ref, 3 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Ice, *Permafrost, Oil spills, Baseline studies, Resources development, Environmental effects, Water pollution sources, Alaska, *Outer Continental Shelf, Coastal processes, Yukon Delta, Petroleum development.

The Yukon-Kuskokwim delta region is characterized by widespread Quaternary tectonism. Evidence of Holocene faulting, coupled with the high potential for liquefaction of most of the Holocene fluvial and deltaic sediments, constitute serious geologic constraints both in the selection of transportation corridors and the design of offshore structures. The risk from explosive volcanism, however, appears slight. Non-tectonic geologic hazards also exist throughout the region. Of these, permafrost may be one of the more difficult to predict, as it appears to be present in various degrees in most areas. The siting of offshore facilities (e.g., drilling platforms, underwater pipelines) must take into account the mobility and deformation of seasonal pack ice, the extent and variability of shorefast ice, the probability of offshore permafrost, and the possible effects of altering offshore bathymetry in changing coastal stability. In addition, the evaluation of possible oil spills must take into account not only the dominant northward drift of water and suspended sediments, and the local and seasonal variability of current patterns, but also the role of sub-ice channels in affecting bedload transport. (Sinha-OEIS)
W80-05587

MECHANICS OF ORIGIN OF PRESSURE RIDGES, SHEAR RIDGES AND HUMMOCK FIELDS IN LANDFAST ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
L. H. Shapiro, H. F. Bates, and W. D. Harrison.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 366-423, October 1979. 12 Fig, 1 Tab, 20 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-55.

Descriptors: *Hazards, *Ice, *Sea ice, *Ice loads, Design, Offshore platforms, Hydrodynamics, Environmental effects, Water pollution sources, Resources development, Baseline studies, Alaska, Monitoring, Coasts, *Outer Continental Shelf, Petroleum development, Landfast ice, Pack ice.

This project is concerned with the mechanisms and processes involved in the deformation of landfast ice, including ridging, hummocking, and interaction with beaches and with the sea floor. The major emphasis has been on the study of overrides of beaches and barrier islands during both the break-up period and mid-winter periods. The potential for override of structures, barrier islands and beaches is recognized as a significant hazard to OCS development. The break-up period was considered to present the greater hazard, however during the winter of 1977-1978, a series of ice push ridges and overrides of barrier islands were observed. This falls within the period which generally has been considered safe for operations and indicates that the potential for large ice movements close to shore during this time cannot be dismissed and must be considered in operating regulations and design considerations. The study of ice sheet vibration forms the second object of this project. In particular, observations suggest that there is an association between rising compressive stress levels in the ice and the occurrence of vibrations with periods on the order of several minutes. If verified, this may provide a relatively simple and inexpensive method of monitoring the build up of stress in the pack ice which may ultimately be transmitted to the landfast ice. As such, it would become an operational tool for providing early warning of potentially hazardous conditions. (Sinha-OEIS)
W80-05589

SUBSEA PERMAFROST: PROBING, THERMAL REGIME AND DATA ANALYSIS,
Alaska Univ., Fairbanks. Geophysical Inst.
W. D. Harrison, and T. E. Osterkamp.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 493-580, October 1979. 26 Fig, 5 Tab, 24 Ref, 2 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-55.

Descriptors: *Hazards, *Permafrost, *Cold regions, Exploration, Drilling, Oil wells, Construction, Resources development, Water pollution sources, Alaska, Environmental effects, *Outer Continental Shelf, Petroleum development, Subsea permafrost.

The objectives of this study are to determine the distribution and properties of subsea permafrost in Alaskan waters. Besides direct measurements, the program includes an effort to understand the basic physical processes responsible for the subsea regime, as a basis for predictive models. By now it should be evident from these and other OCS studies in Alaskan waters that ice-bearing subsea permafrost is widespread and may exist near the sea bed both near and very far from shore. Compared to terrestrial permafrost, subsea permafrost is more complex because it is transient, and because salt becomes a new, important, and unpredictable variable. The subsea permafrost is also much more easily disturbed because of the salt, and because it is warmer. The permafrost-related development problems are therefore probably more serious offshore than onshore. A curious similarity is that excavation of materials may not be feasible offshore at some locations because of shallow ice-bonding. It is found that the permafrost regime on the barrier islands can be highly variable over small distances, a fact that has to be remembered in the interpretation of seismic searches for ice-bonding, and in the siting of structures. For the present the concerns are for the safety of exploratory drilling, but the eventual objective is not only to find, but to produce hydrocarbons. At that stage, permafrost and gas hydrate conditions will be even more important since hot fluids in the well are unavoidable. Thus, it is very important to maximize the derived downhole information at the initial stage of exploratory drilling. (Sinha-OEIS)
W80-05591

DEVELOPMENT OF HARDWARE AND PROCEDURES FOR IN-SITU MEASUREMENT OF CREEP IN SEA ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
L. H. Shapiro, and E. R. Hoskins.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 581-682, October 1979. 16 Fig, 8 Ref, 2 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-

03-5-022-55.

Descriptors: *Hazards, *Sea ice, *Hydrodynamics, Structures, Creep, Water pollution sources, Environmental effects, On-site tests, Alaska, Resources development, *Outer Continental Shelf, Petroleum development, In-situ measurement.

Any permanent or semi-permanent structure located off the Arctic Coast of Alaska must contend with the hazard that sea ice presents to its stability. The extent of this hazard depends on three basic parameters. First, the strength of the structure itself, with respect to its ability to withstand forces of a given magnitude. Second, the geometry of the interaction between the structure and the surrounding ice, including the state of bonding between the two and, finally, the strength of the ice, which determines the maximum force that the ice can sustain in the mode of failure which the structure is designed to induce. The first two of these parameters are determined largely the third, the strength of the ice, and it is to this problem that the project is directed. Techniques for conducting measurements of several of the mechanical properties of sea ice by in-situ methods are described. The tests described all involve the use of flatjacks of various shapes for supplying a known load into the ice. The geometry of the sample being tested is defined by introducing internal boundaries into the ice sheet by cutting slots or installing layers of plastic film. The resulting deformation of the ice is measured by strain gauges embedded in the test sample or by LVDT's or linear potentiometers mounted on pegs which, in turn, are frozen to some depth in the sample. (Sinha-OEIS)
W80-05592

BEAUFORT SEACOAST PERMAFROST STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
J. C. Rogers, and J. L. Morack.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 1-31, October 1979. 12 Fig, 14 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-55.

Descriptors: *Hazards, *Permafrost, *Baseline studies, *Drilling, Oil well, Environmental effects, Resources development, Water pollution sources, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

The Prudhoe Bay area and adjacent offshore islands is the primary focus of this study. The truncation of permafrost beneath the ocean is of interest, particularly the shape of the frozen-nonfrozen boundary. Thus, a major objective of the study is the determination of the shape of the boundary. One important facet is determining the nature and extent of permafrost beneath the barrier islands. These results will provide valuable information for refinement and testing of thermal models as well as for determining operational methods for offshore oil and gas development. Another objective is to provide information to support reconnaissance drilling programs. Drilling provides information on bottom conditions only near the drill hole. It is possible, using the seismic technique, to extend such site specific information to areas remote from the drill site, by correlating seismic data at the drill site and at the remote locations. Also, seismic information can be used to suggest areas for future drilling investigations. (Sinha-OEIS)
W80-05593

A CATASTROPHE MODEL OF THE PALEOCLIMATE,
Maine Univ., Orono. Inst. for Quaternary Studies.
D. R. MacAyeal.
Journal of Glaciology, Vol 24, No 90, p 245-257, 1979. 5 Fig, 22 Ref.

Descriptors: *Paleoclimatology, *Model studies, *Ice cover, *Glaciology, Climates, Mathematical models, Reviews, Fluctuations, Ice, Catastrophes, Interglacial climate.

The presentation of the catastrophe model was preceded by a brief discussion of the chronological pattern of global ice fluctuations. This pattern was shown to imply a two-dimensional set of climate controls. One control was identified with the insolation fluctuations resulting from the Earth's orbital cycles. The second control was designed to account for the apparent changes within the dynamics of large ice masses. Two previous climate models which do not employ the second control parameter were briefly prevented in order to illustrate the inadequacy of simple models which do not account for changeable dynamics. A simple qualitative model of global ice cover was presented to account for the apparent catastrophic transitions between glacial and interglacial climates. Unlike the Budyko and Weertman models, the catastrophe model employs a second control parameter besides the orbitally induced insolation fluctuations to differentiate between fast and slow glaciological response mechanisms. It is conjectured that this second control parameter is linked to isostatic actions occurring beneath the continental crust which shift the dynamic emphasis from terrestrial to marine ice margins. (See also W76-10949) (Humphreys-ISWS)
W80-05669

ICE SHELVES: A REVIEW,
Maine Univ., Orono. Inst. for Quaternary Studies.
R. H. Thomas.
Journal of Glaciology, Vol 24, No 90, p 273-286, 1979. 5 Fig, 46 Ref. NSF DPP76-23047 A01.

Descriptors: *Ice, *Reviews, *Antarctic, *Glaciology, Flow, Icebergs, Dynamics, Movement, Creep, Melting, Interfaces, Freezing, Beds, Sea ice, Analytical techniques, Ice shelves, Ice sheets, Ice flow, Calving.

Ice shelves form where ice flows off the Antarctic ice sheet onto the sea to produce rather flat slabs of floating ice which, for the theoretician, are the simplest of all large ice masses. Boundary conditions are well defined, conditions change very slowly over distances that are large compared with ice thickness, and horizontal velocities are independent of depth. Unconfined ice shelves can be used as giant creep machines to investigate the ice flow law at low stresses. Further inland, where movement is hampered by obstructions such as grounded ice rises and by shear between the ice shelf and its sides, the ice shelf transmits a backpressure which tends to restrict drainage from the ice sheets that feed it. Wastage from ice shelves is principally by calving and by bottom melting. There has been no direct measurement of bottom-melting rates, but indirect evidence suggests that, near the seaward edges of ice shelves, bottom-melting rates may exceed one meter per year, with significant melting within about 100 km of the ice front. Further inland there may be bottom freezing, and analysis of cores taken from the Amery Ice Shelf indicates that bottom-freezing rates average 0.5 m/a over a distance of 200 km. Such high freezing-rates are probably exceptional, and, beneath the Ross Ice Shelf, freezing appears to be insignificant even at a distance of 400 km from the ice front. Because of their accessibility ice shelves have been studied in considerable detail, but many problems remain. In particular, there is a need to improve understanding of basal flux, ice-shelf dynamics near the grounding line, the calving of icebergs, and the state of equilibrium of ice rises. In addition there is a clear need for basic data from the Filchner-Ronne ice shelf. (Humphreys-ISWS)
W80-05670

SATELLITE STUDIES OF FRESH-WATER ICE MOVEMENT ON LAKE ERIE,
National Environmental Satellite Service, Washington, DC.
D. R. Wiesnet.
Journal of Glaciology, Vol 24, No 90, p 415-426, 1979. 13 Fig, 11 Ref.

Descriptors: *Lake ice, *Lake Erie, *Remote sensing, *Ice, Satellites(Artificial), Great Lakes, Surveys, On-site investigations, Ice cover, Movement, Monitoring, Spatial distribution, Landsat, GOES, Ice formation, Ice break-up.

Since the winter of 1972-73, NOAA visible and thermal images of North America have been available for the study of ice on the Great Lakes. The shallowest of the Great Lakes is Lake Erie, on which ice occurs from December usually through April. The NOAA series of polar-orbiting satellites collect two thermal and one visible image per day; the Geostationary Observational Environmental Satellites (GOES) collect visible and infrared images every 30 min. NASA's Landsat satellite has an 18 d revisit cycle (a 9 d cycle when two are operating), with superb ground resolution (79 m). Satellite images from all three satellites were used in this study. Ice formation, movement, and breakup in Lake Erie are different in each sub-basin, Western, Central, and Eastern, owing to the variation in depth of water, geomorphology, and meteorologic factors. Ice movement after initial breakup in 1974-77 resulted in the accumulation of ice at the entrance of the Niagara River at the eastern end of the lake. In 1973, satellite images show the unusual development of an ice dam across the entire width of Lake Erie, and the 'ice plug' at the mouth of the Niagara did not form. The effect of wind direction on breakup patterns was seen to be critical to any attempt at forecasting date of complete ice melt as well as day-to-day distribution of ice. Satellite observation of ice in Lake Erie-- and in all large lakes--provides information regularly, routinely, and synoptically from a point in space. These data are useful for the study of ice formation, movement, and breakup, and they provide an unrivaled and unprecedented data set of historical records. (Humphreys-ISWS)
W80-05672

STABILITY OF GLACIERS AND ICE SHEETS AGAINST FLOW PERTURBATIONS,
Jet Propulsion Lab., Pasadena, CA.
D. E. Thompson.
Journal of Glaciology, Vol 24, No 90, p 427-441, 1979. 5 Fig, 26 Ref. NAS 7-100, NSF DES 73-00597.

Descriptors: *Glaciers, *Stability, *Ice, *Model studies, Flow, Rheology, Movement, Mathematical models, Analytical techniques, Analysis, Viscosity, Strain, Velocity, Theoretical analysis, Wavelengths, Ice sheets, Flow perturbations, Wavelength perturbations.

A stability equation was derived for a model glacier of initially uniform thickness and of infinite extent transverse to the primary flow flowing without slip down an inclined plane. A stress-dependent power-law viscosity was wholly incorporated into the equations of motion. Stability of the glacier was tested against long-wavelength surface perturbations. Results for this initial formulation indicate that the glacier is stable against infinitesimal amplitude surface perturbations, although for certain variations of model parameters, the decay-rate of the disturbance becomes very slow, approaching neutral stability. Results were presented in terms of decay-rate magnitudes over a large range of perturbation wavelengths for many model glaciers in which bed slope, ice thickness, and ice rheology parameters were varied. For all models, the maximum decay-rate of the perturbation occurs at disturbance wavelengths of roughly three to six times the glacier thickness. Infinite-wavelength perturbations are found to be only neutrally stable. Long-wavelength perturbations propagate at a faster rate down-glacier than do the intermediate- or shorter-wavelength ones which tend to remain fixed on the glacier surface and ride down-glacier with the primary flow as they decay. (Humphreys-ISWS)
W80-05696

2E. Streamflow and Runoff

WATER RENEWAL EFFICIENCY OF WATERSHED AND LAKE COMBINATIONS IN THE ELA REGION OF THE PRECAMBRIAN SHIELD,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2A.
W80-05420

EFFECTS OF A WINDSTORM AND FOREST FIRE ON CHEMICAL LOSSES FROM FORESTED WATERSHEDS AND ON THE QUALITY OF RECEIVING STREAMS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5B.
W80-05421

MULTIYEAR LOW FLOW IN SOUTHEASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
W. J. Carswell, Jr.
Geological Survey open-file report 79-1288 (WRI), 1979. 26 p, 14 Fig, 1 Tab, 3 Ref.

Descriptors: *Low flow, *Kansas, *Water supply, *Water shortage, *Streamflow, Droughts, Model studies, Estimating, Low-flow frequency, Flow duration, Water yield, Water utilization, Streamflow forecasting, Surface waters, Reservoirs, Evaluation, Hydrologic data, Gaging stations, *Southeastern Kansas.

Many existing water supplies in southeastern Kansas are proving inadequate to meet current and expanded future needs. One of the methods in which the use of highly variable streamflow in the area can be evaluated is with the aid of multiyear low-flow frequency information. Data from 19 stream-gaging stations in the study area and a base period of 1940-77 were used to develop maps from which discharge values for the 2- and 50-year recurrence interval for durations of 12, 24, 36, and 60 months can be obtained for ungaged sites that have drainage areas of less than 1,000 square miles. Discharge values for intervening recurrence intervals can be obtained by interpolation. Extrapolation of regionalized values in this report to drainage areas smaller than 110 square miles and larger than 1,000 square miles has not been validated. (Kosco-USGS)
W80-05452

SOIL TREND IN HYDROLOGY,
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
M. I. Lvovich.
Hydrological Sciences Bulletin, Vol 25, No 1, p 33-45, March 1980. 4 Fig, 2 Tab, 22 Ref.

Descriptors: *Hydrology, *Soils, *Soil properties, *Reviews, Theoretical analysis, Farm management, Agriculture, Runoff, Infiltration, Evaporation, Water balance, Forests, Forest watersheds, Groundwater, Recharge, Urban runoff, Urbanization, Watersheds(Basins), Climatology.

The paper presented an historical review of the development of the study of hydrology with particular reference to the role of soil. The theoretical dependences of the water balance elements on the physical properties of soils were discussed, as were the practical effects of different soil types, different land uses, changing agricultural practices, and urbanization. (Sims-ISWS)
W80-05497

THE PROPAGATION OF WAVES IN SHALLOW WATER FLOW WITH LATERAL INFLOW,
Institute of Hydrology, Wallingford (England).
E. M. Morris.
Hydrological Sciences Bulletin, Vol 25, No 1, p 25-32, March 1980. 3 Fig, 2 Ref.

Descriptors: *Waves(Water), *Shallow water, *Model studies, Mathematical models, Computer models, Froude number, Equations, Hydraulics, Flow, Fluid mechanics, Wave propagation, Perturbation analysis, Amplitude, Lateral inflow.

The propagation characteristics of small amplitude waves in shallow water flow with lateral inflow were determined using a linear perturbation method. Expressions relating the celerity, attenuation, and wave number of the waves were given and used to establish two critical values of the Froude number. (Sims-ISWS)
W80-05498

STORM WATER MANAGEMENT MODEL VERIFICATION STUDY.
Dillon (M. M.) Ltd, Toronto (Ontario).
For primary bibliographic entry see Field 2A.
W80-05565

BRUCEWOOD URBAN TEST CATCHMENT.
MacLaren (James F.) Ltd., Toronto (Ontario).
Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No 100, (1980) 67 p, 19 Fig, 15 Tab, 7 Ref.

Descriptors: *Canada, *Urban runoff, *Storm runoff, *Mathematical models, Water sampling, Combined sewers, Surface runoff, Simulated rainfall, Simulation analysis, Water pollution sources, Snowmelt, Runoff forecasting, Hyetographs, Pollutographs.

Data collected from the monitoring of storm water flows in the Brucewood subdivision in North York, Toronto, were used to develop and verify the US Environmental Protection Agency's Storm Water Management Model (SWMM). Brucewood was selected as a typical modern subdivision for this study of the feasibility of using a computer model, SWMM, to predict the quantity and quality of storm water runoff due to rain storms and melting snow. Brucewood is a 48-acre development consisting of single-family and semi-detached residences built in the late 1960's. House roof leaders are connected to separate storm sewers which are connected to the 39 in main trunk of the sewer system which discharges into the East Don River. During the period February 15, 1974 through December 31, 1975, data were collected including precipitation measurement, flow measurement, and water quality samples, for a total of 76 events. Several events were simulated using SWMM, a comprehensive mathematical model requiring inputs such as the temporal distribution of rainfall intensity (hyetograph) and data describing the idealized catchment, transport, and receiving water systems. The model represents flow and the associated pollution as continuous curves, hydrographs and pollutographs. Quantity simulations compared reasonably well with recorded flows, however, quality simulations were not as accurate, probably due to the more complex phenomena involved. Simulated pollutant concentrations were generally in good agreement with recorded values. (Seigler-IPA)
W80-05566

RIPARIAN FORESTS IN CALIFORNIA: THEIR ECOLOGY AND CONSERVATION.
California Univ., Davis. Inst. of Ecology.
Institute of Ecology Publication No 15, California University, Davis, May, 1977. 122 p.

Descriptors: *Riparian water, *Forests, *California, *Ecology, *Conservation, Riparian plants, Conferences, History.

Thirteen papers were presented at a symposium on the riparian forests in California. Symposium topics were divided into two sessions: one dealing with historical and ecological subjects and the other with management and preservation. Papers were arranged so that background data came first and were followed by a developmental sequence beginning with the evolution of riparian ecosystems and ending with a discussion of the value of riparian forests in today's society. (See W80-05607 thru W80-05614) (Steiner-Mass)
W80-05606

A SURVEY OF RIPARIAN FOREST FLORA AND FAUNA IN CALIFORNIA,
California Univ., Davis.
For primary bibliographic entry see Field 2I.
W80-05607

GEOLOGIC HISTORY OF THE RIPARIAN FORESTS OF CALIFORNIA,
California Univ., Davis. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-05608

RIPARIAN FORESTS OF THE SACRAMENTO VALLEY, CALIFORNIA,
California Univ., Davis. Dept. of Geography.
For primary bibliographic entry see Field 2I.
W80-05609

RIPARIAN VEGETATION AND FLORA OF THE SACRAMENTO VALLEY,
California Univ., Davis.
For primary bibliographic entry see Field 2I.
W80-05611

THE VALLEY RIPARIAN FORESTS OF CALIFORNIA: THEIR IMPORTANCE TO BIRD POPULATIONS,
For primary bibliographic entry see Field 2I.
W80-05612

HABITATS OF NATIVE FISHES IN THE SACRAMENTO RIVER BASIN,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
For primary bibliographic entry see Field 6G.
W80-05613

2F. Groundwater

SPRING CHARACTERISTICS OF THE WESTERN ROSWELL ARTESIAN BASIN,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
P. Davis, R. Wilcox, and G. W. Gross.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-204357, Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, Partial Technical Completion Report No 116, January 1980. 93 p, 40 Fig, 7 Tab, 14 Ref, 3 Append. OWRT A-055-NMEX(3), 14-34-0001-9033.

Descriptors: *Groundwater movement, *Groundwater recharge, *Tritium, *Springs, *New Mexico, Hydrogeology, Drainage area, Mountains, Water wells, Water analysis, Chemical analysis, *Yeso-San Andres Formation(NM), *Western Roswell Artesian basin(NM).

Recharge transmitted underground from the western rim of the Roswell artesian basin, the Sacramento Mountains, substantially contributes to the groundwater supply of the basin. This recharge occurs by either groundwater flow eastward along the Yeso-San Andres Formation contact or by springs discharging into the main drainage 'routes' which subsequently lose their flow in the Principal Intake Area to the east. The major geologic controls of spring occurrence are silts and clays within the Yeso Formation which act as aquitards under the spring groundwater systems, and collapse features within the Yeso Formation which generally act as high permeability zones. Chemistry of the spring water is more variable in the north than in the southern part of the basin. This is due to the different geologic settings for the two areas. Springs issue from three types of hydrologic systems: perched springs issuing well above the canyon floors, valley underflow springs issuing from alluvium in the canyon floors, and, possibly, springs which issue from a regional groundwater system. Tritium analyses indicate that valley underflow and regional springs discharge relatively older water than perched springs. (Herman-NMex).
W80-05406

IN SITU MEASUREMENTS OF PORE WATER DIFFUSION COEFFICIENTS USING TRITIATED WATER,
Lamont-Doherty Geological Observatory, Palisades, NY.
R. H. Hesslein.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 545-551, March 1980. 11 Fig, 1 Tab, 14 Ref.

Descriptors: *Diffusion, *Pore water, *Tritium, *Lake sediments, *Canada, Measurement, Ground-

water movement, Profiles, Numerical analysis, Mathematical models, Equations, Mixing, Surface-groundwater relationships, *Canada, Diffusion coefficient, In situ measurement.

In situ diffusion coefficients in the pore waters of Lake 227 in northwestern Ontario were measured by monitoring the movement of tritiated water into the pore waters. The diffusion coefficients were determined by analytical and numerical modeling of the tritium profiles. During the summer, tritiated water diffuses into the sediment by molecular diffusion, and this process is well approximated by a constant diffusivity model. The summer coefficients for diffusion were 1-2 x 100,000 cu cm/s at a water depth of 1.5 m (20C) and 0.3-0.8 x 100,000 cu cm/s at 8.75 m (4C). During fall overturn, clear evidence was found for enhanced mixing of pore waters to a sediment depth of 10 cm at water depths of 0.75 and 3.85 m. This enhanced mixing was not accompanied by mixing of the solid phase of the sediments. (Visocky-ISWS)
W80-05424

GROUND-WATER RECHARGE TO THE AQUIFERS OF NORTHERN SAN LUIS VALLEY, COLORADO: SUMMARY,
San Diego State Univ., CA. Dept. of Geological Sciences.
D. Huntley.
Geological Society of America Bulletin, Part I, Vol 90, No 8, p 707-709, August, 1979. 1 Fig, 1 Ref.

Descriptors: *Ground water recharge, *Confined aquifers, *Unconfined aquifers, *Colorado, Hydrologic budget, Geology, Hydrogeology, Geochemistry, Ground water movement, Flowsystem, Surface waters, Discharge(Water), Permeability, Mountains, Valleys.

The northern San Luis Basin can be divided into three hydrologically connected regions based on water budget, geology, hydrochemistry, and modeled ground water flow patterns. The Sangre de Cristo Mountains and the San Juan Mountains, with different proportions of stream flow and ground water flow, are the major recharge area for confined and unconfined aquifers in the San Luis Valley. The Sangre de Cristo Mountain Range is a region of low, depth-dependent permeability, local ground water flow systems, and high rates of surface water flow. The San Juan Mountain Range is a region of moderate to high permeability, regional flow systems, and low rates of surface water discharge. There is little or no hydrologic discontinuity between the San Juan Mountains and San Luis Valley as the permeabilities are nearly the same in the two regions. Ground water recharge to the confined aquifer in the eastern San Luis Valley is from downward movement of water from an unconfined aquifer. Recharge in western San Luis Valley is entirely from direct ground water flow from the volcanic aquifers of the San Juan Mountains. There is considerable hydraulic continuity between the confined and unconfined aquifers in the San Luis Valley. (Purdin-NWWA)
W80-05430

HYDROLOGY AND GEOCHEMISTRY OF THERMAL SPRINGS OF THE APPALACHIANS,
Geological Survey, Morgantown, WV. Water Resources Div.
For primary bibliographic entry see Field 1A.
W80-05457

PRELIMINARY ESTIMATE OF REGIONAL EFFECTIVE GROUNDWATER RECHARGE RATES IN OHIO,
Ohio State Univ., Columbus. Dept. of Geology and Mineralogy.
W. A. Pettyjohn, and R. J. Henning.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193535, Price codes: A15 in paper copy, A01 in microfiche. Water Resources Center, The Ohio State University Project Completion Report, 1979. 323 p, 49 Fig, 45 Tab, 27 Ref, Append. OWRT-A-051-OHIO(1).

Descriptors: *Groundwater recharge, *Base flow, *Duration curves, Hydrograph analysis, Forecasting, Surface groundwater, Water relationships, Natural recharge, Streamflow, Water quality, Computer programs, Ohio, *Hydrograph separations.

Regional effective ground-water recharge rates during years of low, normal and high precipitation were calculated for Ohio by means of stream hydrograph separations using an IBM 360/168. The included programs also produce tables of monthly and annual recharge rates, separated stream hydrographs, flow-duration curves and tables, quality-duration curves and tables, as well as quality-ratio graphs. Computer output is compared with manual separation techniques. During a year of normal precipitation, the average effective recharge rate for bedrock (sandstone, shale, limestone) was 179,000 gpd/mi. sq., for glacial till was 220,000, for glacial till and some outwash along streams was 312,000, for bedrock with extensive strip and underground mines was 312,000, for outwash and till was 350,000 and for extensive and very permeable outwash was 426,000 gpd/mi. sq. The greatest amount of recharge, generally exceeding 1,000,000 gpd/mi. sq., usually occurs in March, while the lowest monthly rates, commonly less than 100,000 gpd/mi. sq., appear from June to October. The chemical quality of streams during dry-weather flow, as expected, is similar to shallow ground water except where streams are contaminated.
W80-05466

STOCHASTIC FORECASTING OF MINE WATER INRUSHES,
Mining Development Inst., Budapest (Hungary).
For primary bibliographic entry see Field 6A.
W80-05477

USE OF MICROCOMPUTERS IN GROUNDWATER BASIN MODELING,
California State Dept. of Water Resources, Los Angeles.
K. W. Mido.
Ground Water, Vol 18, No 3, p 230-235, May-June 1980. 1 Tab, 4 Ref.

Descriptors: *Groundwater, *Aquifers, *Water levels, *Model studies, Mathematical models, Computers, Computer models, Computer programs, Equations, Costs, Equipment, Cost-benefit analysis, Hydrology, *Microcomputers.

It was demonstrated that a microcomputer costing less than $10,000 can accommodate a groundwater basin model with a large number of nodes. Analyses indicated that finite difference and finite element models with several hundred nodes also can be accommodated. Microcomputers have several advantages over the larger and much more expensive macrocomputers as groundwater basin modeling tools: easy to learn language used for programming, simplicity of operation, and low costs leading to easy access by investigators and users. Because of these advantages, willing investigators can learn to do modeling work by using a microcomputer and also write programs to computerize time-consuming tasks and thus effect substantial manpower cost savings. (Sims-ISWS)
W80-05484

GROUND-WATER MODELING: MATHEMATICAL MODELS,
GeoTrans, Inc., Reston, VA.
J. W. Mercer, and C. R. Faust.
Ground Water, Vol 18, No 3, p 212-227, May-June 1980. 10 Fig, 4 Tab, 22 Ref, 2 Append. EPA R-803713.

Descriptors: *Groundwater, *Model studies, *Mathematical models, *Reviews, Groundwater movement, Drawdown, Water levels, Path of pollutants, Flow, Darcys law, Mass transfer, Heat flow, Heat transfer, Equations, Theoretical analysis, Hydrology.

Groundwater modeling begins with a conceptual understanding of the physical problem. The next step in modeling is translating the physical system into mathematical terms. In general, the final results are the familiar groundwater flow equation and transport equations. These equations, however, are often simplified, using site-specific assumptions, to form a variety of equation subsets. An understanding of these equations and their associated boundary and initial conditions is necessary before a modeling problem can be formulated. (Sims-ISWS)
W80-05485

A REVIEW OF TECHNIQUES FOR STUDYING FRESHWATER/SEAWATER RELATIONSHIPS IN COASTAL AND ISLAND GROUNDWATER FLOW SYSTEMS,
Guam Univ., Agana. Water Resources Research Center.
D. N. Contractor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193857, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 11, 1980. 26 p, 1 Fig, 22 Ref. OWRT A-007-GUAM(1), 14-34-0001-7024, 9012.

Descriptors: *Groundwater movement, *Saline water-freshwater interfaces, Pacific Ocean, *Islands, Saline water intrusion, Aquifer characteristics, Analytical techniques, *Guam, Micronesia, Mariana Islands.

This report reviews and summarizes the analytic and numeric methods available for the study of saltwater intrusion into freshwater aquifers in coastal and island situations. The methods are divided into three categories. The first deals with closed-form analytic solutions of steady interface problems using the hodograph method. In these problems, the saltwater and freshwater are separated by an abrupt interface and the location of this interface is determined for simple aquifer geometries and boundary conditions. These solutions can also be used to test the accuracy of numerical techniques. The second category of methods deals with solutions utilizing the Dupuit and Ghyben-Herzberg approximations. The unsteady equations in one and two dimensions that need to be solved are presented. Numerical approximations of these differential equations are suggested and results reported in the literature. The last category of methods deals with numerical solutions of the convection-dispersion equation. A finite element solution of the equations applied to a vertical two-dimensional plane is presented. This method results in the concentration of salt as a function of space and time. The advantages and limitations of all the methods are discussed.
W80-05538

THE GHURA-DEDEDO DEEP MONITORING WELL: PLANNING AND DESIGN,
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 8A.
W80-05540

USING MODELS TO SIMULATE THE MOVEMENT OF CONTAMINANTS THROUGH GROUND WATER FLOW SYSTEMS,
Wisconsin Univ., Madison. Dept. of Geology and Geophysics.
M. P. Anderson.
CRC Critical Reviews in Environmental Control, Vol 9, Issue 2, p 97-156, November, 1979. 5 Fig, 4 Tab, 225 Ref.

Descriptors: *Computer models, *Ground water movement, *Pollutants, *Flow system, Model studies, Unsaturated flow, Saturated flow, Porous media, Fracture permeability, Dispersion, Advection, Hydrologic data, Chemical reactions, Parametric hydrology, Numerical analysis, Data collections.

This paper examines the formulation of contaminant transport models, application to field problems, difficulties involved in obtaining input data, and current status of modeling efforts. Models that predict movement of contaminants through both the unsaturated and saturated zones are discussed, but transport through the unsaturated zone is not

considered. Also, the models were developed to simulate migration through porous media rather than through rock fractures. Contaminant transport models which include the effects of dispersion have been applied to several field situations. However, factors that limit the routine use of these models include the difficulty of determining the field coefficient of dispersion and numerical difficulties encountered when solving the dispersion equation. Regional-size advection models which neglect the effects of dispersion have had limited success because of the scarcity and poor quality of field data. Another difficulty in the development of contaminant transport models is the current lack of knowledge regarding the quantification of chemical reaction terms in both advection-dispersion models and advection model. Advections-dispersion models are subdivided into sections dealing with one and two-dimensional areal and profile models and three-dimensional models. Advection models are subdivided into distributed parameters models and lumped parameter models. (Purdin-NWWA)
W80-05547

GROUNDWATER REGIME ASSOCIATED WITH SLOPE STABILITY IN CHAMPLAIN CLAY DEPOSITS,
Ecole Polytechnique, Montreal (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8D.
W80-05555

ANALYSIS, CRITIQUE, AND REEVALUATION OF HIGH-LEVEL WASTE REPOSITORY WATER INTRUSION SCENARIO STUDIES,
Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
For primary bibliographic entry see Field 5E.
W80-05556

SEEPAGE IN THE PARTIALLY SATURATED ZONE BENEATH TAILINGS IMPOUNDMENTS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. B. McWhorter, and J. D. Nelson.
Mining Engineering, Vol 32, No 4, p 432-439, April, 1980. 6 Fig, 3 Tab, 14 Ref.

Descriptors: *Seepage, *Mine wastes, *Waste dumps, Subsurface drainage, Infiltration, Unsaturated flow, Wetting front, Ground water mounds, Saturated flow, Estimating, Linings, Clays, Porous media, Flow resistance.

Estimates of seepage losses from tailings impoundments are required to assess potential environmental impacts and to calculate water balance. When impoundments are located above a partially saturated zone, conventional methods of analysis for saturated flow through porous media do not apply. Seepage is simplified into three stages: (1) a wetting front infiltrates through the partially saturated material; (2) the wetting front contacts an aquiclude or aquifer and a ground water mound develops; and (3) the ground water mound contacts the impoundment and saturated seepage occurs. Methods of estimating seepage rates and the duration of each stage, based on flow in partially saturated and saturated porous media, are demonstrated. The effectiveness of clay liners is briefly discussed and procedures that may be used to estimate the required properties of the porous media are outlined. In a hypothetical application using reasonable values for all required data, the single most important factor influencing seepage rates was the resistance to flow through the liner which is a function of the permeability and thickness of the liner. (Purdin-NWWA)
W80-05557

REGIONAL AQUIFER PARAMETERS EVALUATED DURING MINE DEPRESSURIZATION IN THE ATHABASCA OIL SANDS, ALBERTA,
Northern Illinois Univ., DeKalb. Dept. of Geology.
D. A. Hackbarth.
Canadian Geotechnical Journal, Vol 17, No 1, p 131-135, February, 1980. 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Oil sands, *Sand aquifers, *Aquifer testing, *Aquifer characteristics, Canada, Dewatering, Transmissivity, Homogeneity, Anisotropy, Theis equation, Drawdown.

A ground water observation well network was installed in the Athabasca Oil Sands area of northeastern Alberta to predict and assess technical and environmental problems associated with the exploitation of oil sands. Withdrawal of ground water for depressurization of an aquifer under a test pit caused water level declines in wells 3700 m southeast and 6600 m northwest of the pit. Analysis of these drawdowns indicated a transmissivity of 68 sq. m/day for both wells. Previous short-term pump tests have indicated transmissivities that range up to 200 sq. m/day. This is due to the nonhomogeneous and anisotropic nature of the aquifer. Nevertheless, it responds to long-term pumping at large distances from the pumped well as if it were a homogeneous and isotropic aquifer satisfying all of the conditions required for the application of the Theis nonequilibrium equation. (Purdin-NWWA)
W80-05558

DEPOSITIONAL CONTROL OF AQUIFER CHARACTERISTICS IN ALLUVIAL FANS, FRESNO COUNTY, CALIFORNIA: SUMMARY,
Science and Education Administration, Fresno, CA. Water Management Research.
For primary bibliographic entry see Field 2J.
W80-05610

HYDROGEOLOGY OF SEDIMENTARY ROCKS--CLASTICS,
B. R. Whitehead.
Canadian Water Well, Vol 6, No 2, p 20, May, 1980.

Descriptors: *Hydrogeology, *Sandstones, *Shales, Weathering, Particle size, Sediment transport, Lithification, Diagenesis, Porosity, Permeability, Fracture permeability, Water yield, Water quality, Salinity.

Weathering processes reduce rock to quartz, feldspar, and clay minerals. Grain size varies with type of erosion, distance from provenance, and grain size of parent rock. In most cases, residues are transported by water to lakes or oceans where they are deposited and later cemented to form sandstone and shale. Post depositional changes such as fracturing, or precipitation and dissolution of material by percolating ground water can change porosity and permeability. In sandstone, permeability is developed in the interconnected pore spaces and the fracture system. Highly compacted or cemented zones will have lowerwell yields. However, these zones are more prone to fracturing which increases vertical permeability. Because of the variability of sandstone, it is impossible to assign a range of yields. Shale is generally a poor aquifer, yielding small supplies of water to domestic wells, due to low intergranular permeability and the tendency of fractures to close as a result of plasticity or weathering. Water from sandstone may be hard if the cementing agent is calcite. Shale water usually contains chlorides from connate seawater or salt deposits. Salinity increases with depth for both shale and sandstone. Shale water may also contain sulfate, iron, and methane and frequently requires treatment. (Purdin-NWWA)
W80-05617

INVESTIGATION OF THE HYDROLOGICAL BALANCE IN A PEAT SWAMP,
Brussels Univ., (Belgium).
F. DeSmedt, A. Van Der Beken, and G. Demaree.
Journal of Hydrology, Vol 34, p 151-160, 1977. 5 Fig, 2 Tab, 5 Ref.

Descriptors: *Swamps, *Hydrologic cycle, Wetlands, Peat, Groundwater, Model studies, Hydrologic budget.

The soil of the bird sanctuary 'De Zegge' consists of an alluvion layer overlaying a peat layer. A hydrological balance of the area is constructed with the aid of weekly measurements of water or groundwater levels at several places in the swamp. In a first model only horizontal groundwater flow in the alluvion layer is taken into consideration. The calibration of the model is executed with a linear regression. This model is strongly improved when vertical flow in and out of the peat layer is taken into account. The vertical flow is assumed to be proportional with the difference in hydraulic head. Again, linear regression is used to calibrate this model. In a third non-linear model, the flow in the peat is assumed to be non-Darcian. With pattern search, a non-linear optimization technique, it is shown that this model is not better than the foregoing. (Steiner-Mass)
W80-05633

2G. Water In Soils

SIMULTANEOUS TRANSPORT OF WATER AND 3HOH IN WATER,
Arkansas Agricultural Experiment Station, Fayetteville.
H. D. Scott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-194848, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arkansas WRRC Series 66, Special Report 78, April 1980. 70 p, 17 Fig, 7 Tab, 17 Ref, 1 Append. OWRT-A-039-ARK(3).

Descriptors: *Soil water movement, *Subsurface flow, *Diffusion, Regression analysis, Soil investigations, Tritium, Tracers, Radioisotopes, Solutes, Aqueous solutions, Soil density, Silts, Loam, Soil properties, Pore pressure.

The effect of parameters such as soil water flow velocity, equilibrium time, direction of flow, and initial soil water content on the magnitude of the transport coefficients of tritiated water (3HOH) was studied using a modification of the 'quick freeze' technique. For the study a captina silt loam was air-dried, ground to 2mm or less and mixed thoroughly. Following soil moisture content adjustments and the addition of 3HOH, 50-g samples were hand-packed into cylindrical plexiglas half-cells. The cells were equilibrated, frozen, and sliced in 500 micron sections. Liquid scintillation techniques were used to analyze radioactivity. Movement of 3HOH in the same direction as water was studied along with the movement of 3HOH in the opposite direction to that of water. Dispersion coefficients were found to be velocity dependent for equilibration times ranging to 21 hours. Time needed for the dispersion coefficients to become independent of flow velocity increased as average pore velocity increased. Dispersion coefficients increased as flow velocity increased, and decreased as soil water content decreased for the transport of 3HOH and water in the same direction. For the transport of 3HOH in the opposite direction as water, dispersion coefficients increased as flow velocity increased. Dispersion coefficients for both directions of 3HOH movement could be described by linear regression models. For both directions of flow the dominant transport mechanism at low flow velocities was diffusion, while at high flow velocities, hydrodynamic dispersion was dominant. (Seigler-IPA)
W80-05472

AERIAL GAMMA SURVEY OF SNOW COVER AND SOIL MOISTURE,
Gosgimet, Moscow (USSR).
For primary bibliographic entry see Field 7B.
W80-05494

SOIL TREND IN HYDROLOGY,
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
For primary bibliographic entry see Field 2E.
W80-05497

SOIL MODIFICATION TO MINIMIZE MOVEMENT OF POLLUTANTS FROM SOLID WASTE OPERATIONS,

Arizona Univ., Tucson. Dept. of Soil, Water, and Engineering.
For primary bibliographic entry see Field 5G.
W80-05545

THE EFFECT OF SAND CONTENT UPON CONE INDEX AND SELECTED PHYSICAL PROPERTIES,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
C. W. Byrd, and D. K. Cassel.
Soil Science, Vol 129, No 4, p 197-204, April 1980. 6 Fig, 2 Tab, 15 Ref.

Descriptors: *Soil physical properties, *Soil water, *Laboratory tests, Soils, Hydraulic conductivity, Sampling, Particle size, Clays, Sands, Silts, Soil moisture, Water pressure, Pores, Porous media, Analysis, *Cone index, Norfolk sandy loam, Reconstituted soil.

Soil collected from an induced tillage pan in the A2 horizon of a Norfolk sandy loam soil was fractionated into sand, silt, and clay separates and reconstituted, yielding four soil textures, each having approximately 5% clay, but with sand percentages ranging from 66.6 to 82.2%. Twelve soil cores for each texture were packed to bulk densities of 1.79 + or - 0.03 g/cu m. Cone index (CI), the soil water characteristic, pore-size distribution, and saturated hydraulic conductivity (K) were measured for the induced pan and the reconstituted soil cores. The cone indices for the undisturbed cores of induced pan were significantly greater than for the reconstituted soil for the same texture. Saturated hydraulic conductivity of the undisturbed pan was only slightly greater than for the disturbed pan material having the same texture. For the reconstituted soils, saturated hydraulic conductivity increased, and the volume of water-filled pores at soil water pressures less than -80 mb decreased as the percentage of sand increased. The cone index for each texture increased monotonically with decreasing soil water pressure, but no simple relationship between CI and texture was found. Regression equations relating CI to water content, percentage of sand, and the volume of pores greater than 150 micrometers in diameter were developed, were significant at the 0.0001 probability level, and explained 67 to 72% of the observed variability. (Humphreys-ISWS)
W80-05628

ANOMALOUS TRANSMISSIONS OF WATER THROUGH CERTAIN PEATS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
H. A. P. Ingram, D. W. Rycroft, and D. J. A. Williams.
Journal of Hydrology, Vol 22, p 213-218, 1974. 5 Fig, 12 Ref.

Descriptors: *Hydraulic conductivity, *Peat, Wetlands, Flow, Flow rates, Percolation, Permeability, Groundwater movement, Darcys law, Soil water movement.

Field experiments are described in which seepage tubes were used under variable-head and constant-head conditions. The estimates of 'hydraulic conductivity' obtained from humified peat showed time dependence, but they also increased with head, indicating departure from Darcy's law. It is suggested that this law is only obeyed in unhumified peat. (Steiner-Mass)
W80-05635

SOLUTE TRANSPORT THROUGH SOIL WITH ADSORPTION AND ROOT WATER UPTAKE COMPUTED WITH A TRANSIENT AND A CONSTANT-FLUX MODEL,
Goettingen Univ. (Germany, F.R.). Inst. of Soil Science and Forest Nutrition.
F. Beese, and P. J. Wierenga.
Soil Science, Vol 129, No 4, p 245-252, April 1980. 10 Fig, 1 Tab, 15 Ref.

Descriptors: *Soil water movement, *Porous media, *Model studies, *Unsaturated flow, Root zone, Percolation, Infiltration, Mathematical models, Analytical techniques, Analysis, Hydraulic conductivity, Soil water, Moisture content, Pore water, Root water.

The objective of this study was to compare solute distribution profiles obtained with a transient-water model and a solute-flow model to those of the constant-infiltration transport model, when interaction of the solute with the soil matrix and root water uptake is considered. The first model is rather complex and requires a complete description of the soil hydrological properties. The second model is much simpler and uses an average percolation rate as input. Solute transport was compared with and without adsorption and with and without root water uptake. The results show that the relative solute concentration at a given soil depth, as a function of cumulative drainage of an intermittently irrigated soil, is a smooth curve, which can also be simulated with the simple model. This is true for both bare and cropped soil profiles, and also for both adsorbing and nonadsorbing chemicals. Such models are apparently appropriate for predicting solute transport through field soils with their inherent spatial variability in physical and chemical properties. These simpler models are preferable for estimating solute transport under field conditions, where first-order estimates are required and the necessary input data are lacking for fully transient solute transport models. (Humphreys-ISWS)
W80-05642

MICROBIOLOGICAL AND PHYSICAL PROPERTIES OF SALT MARSH AND MICROECOSYSTEM SEDIMENTS,
South Carolina Univ., Columbia.
M. Reichgott, and L. H. Stevenson.
Applied and Environmental Microbiology, Vol 36, No 5, p 662-667, November, 1978. 2 Fig, 3 Tab, 22 Ref.

Descriptors: *Soil bacteria, *Sediments, *Salt marshes, Aquatic bacteria, Wetlands, Environmental effects, Marshes, Muck soils, Physical properties, Microbiology.

Sediments from natural marsh and four microecosystem (MES) tanks were compared with reference to ATP, carbon content, and physical properties. Mean values for bacterial numbers and ATP were about twice as high in the MES, carbon content was slightly higher in the artificial systems, and the sediment of the MES was enriched for larger grain sizes and depleted of silt and clay. In the natural marsh sediment, ATP was strongly related (Pearson's correlation coefficient) to granulometric (or physical) factors, whereas ATP was related to biological factors in the MES. Approximately 61% of the variation in ATP concentrations in the marsh sediments could be accounted for by the parameters measured. Only half that amount could be explained on the basis of those same variables in the MES. Furthermore, one of the four tanks was significantly different from the other three in terms of ATP concentration, and an anomaly in respect to silt-clay content was demonstrated in another. Careful control and some type of equilibrating procedure will be necessary before the MES can be employed as replicate units. (Steiner-Mass)
W80-05651

PEAT DEPTH OF SIERRA NEVADA FENS, AND PROFILE CHANGES FROM 1958 TO 1972 IN MASON FEN,
California Univ., Berkeley. Dept. of Forestry and Conservation.
For primary bibliographic entry see Field 2H.
W80-05666

ARYLSULFATASE ACTIVITY IN SALT MARSH SOILS,
Georgia Univ., Athens. Dept. of Microbiology.
For primary bibliographic entry see Field 2K.
W80-05674

2H. Lakes

ERRORS IN MOLYBDENUM BLUE METHODS FOR DETERMINING ORTHOPOHOSPHATE IN FRESHWATER,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
M. P. Stainton.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 472-478, March 1980. 7 Fig, 1 Tab, 18 Ref.

Descriptors: *Phosphorus compounds, *Lakes, *Chemical analysis, *Analytical techniques, Nutrients, Pollutants, Pollutant identification, Phosphorus, Phosphates, Tracers, Radioisotopes, Molybdenum, Chemicals, Water chemistry, Freshwater, Limnology, *Canada, *Orthophosphate, Analytical errors, Molybdenum blue methods.

Whole lakewater was spiked with carrier free 32PO4, filtered through a 0.45-micrometer membrane filter, and the filtrate was fractionated using G025 Sephadex. Three molecular weight fractions incorporated 32P labeling, one of which was colloidal. This labeled filtrate was treated with several variations of the molybdenum blue method for measuring orthophosphate followed by molecular weight fractionation. All variations in the molybdenum blue method caused a significant loss of phosphorus from the colloidal fraction. Phosphorus originating from the colloidal fraction tested as orthophosphate giving an overestimate of the true orthophosphate present. (Sims-ISWS)
W80-05411

GAS EXCHANGE, PHOTOSYNTHETIC UPTAKE, AND CARBON BUDGET FOR A RADIOCARBON ADDITION TO A SMALL ENCLOSURE IN A STRATIFIED LAKE,
Lamont-Doherty Geological Observatory, Palisades, NY.
P. Bower, and D. McCorkle.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 464-471, March 1980. 3 Fig, 2 Tab, 31 Ref. NSF OCE75-15105.

Descriptors: *Carbon, *Gases, *Photosynthesis, *Lakes, On-site investigations, Sampling, Model studies, Mathematical models, Isotope studies, Radioisotopes, Phytoplakton, Carbon dioxide, Water temperature, Hydrogen ion concentration, Limnology, *Canada, Gas exchange, Carbon budget.

9250 kBq (250 micro-Ci) of 14C as NaHCO3 were added to the mixed-layer waters inside a long, cylindrical plastic enclosure anchored in an oligotrophic lake of the Canadian Shield. Loss of 14C from the epilimnion was predominantly in the form of irreversible gas-exchange across the liquid-air interface. This loss was measured by 14C inventory of the epilimnion and thermocline waters. Using the Lewis and Whitman boundary layer model, values for the mass transfer coefficient of 126, 58, and 100 cm/d were determined for three distinct phases in the deepening of the epilimnion during autumn cooling. The relationship between these mass transfer coefficients and the average wind speeds over the same three time periods were consistent with the results of previous wind-tunnel, gas-exchange experiments. Two significant features of the carbon budget during the course of the experiment were the large net outflux of CO2 from the corral (with P sub CO2 in the epilimnion 3-7 times atmospheric levels) and the doubling of the total dissolved inorganic carbon (DIC) content of the epilimnion. The major source of carbon for these two processes was the entrainment of dissolved inorganic carbon as the epilimnion deepened during the cool days of late summer. Particulate organic carbon was also entrained, and its oxidation contributed to the net DIC increase and CO2 loss. Simultaneous determinations of daily integral primary productivity by incubator technique and by direct measurement of 14C uptake inside the enclosure were consistent. Dark respiration was 45-53% of daily integral primary productivity, but total respiration was nearly two times that for dark plus light respiration. Net primary productivity was thus substantially negative. (Sims-ISWS)

W80-05412

WHOLE-LAKE RADIOCARBON EXPERIMENT IN AN OLIGOTROPHIC LAKE AT THE EXPERIMENTAL LAKES AREA, NORTHWESTERN ONTARIO,
Lamont-Doherty Geological Observatory, Palisades, NY.
R. H. Hesslein, W. S. Broecker, P. D. Quay, and D. W. Schindler.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 454-463, March 1980. 7 Fig, 8 Tab, 16 Ref. NSF OCE75-15105.

Descriptors: *Isotope studies, *Carbon, *Lakes, *Canada, On-site investigations, Sampling, Plankton, Primary productivity, Hydrogen ion concentration, Temperature, Water temperature, Radioisotopes, Carbon radioisotopes, Radium radioisotopes, Carbon dioxide, Epilimnion, Gases, Limnology, Carbon budget, Gas exchange, Carbon in lakes, Whole-lake radiocarbon experiments.

To gain more insight into the nature of carbon cycling in lakes and to provide a check on estimates of carbon fluxes obtained by more conventional means, 1 Ci(= 37 GBq) of C14 as NaHCO3 was added to the epilimnion of Lake 224, a dimictic, oligotrophic lake of the Canadian Shield near Kenora, Ontario. The dominant loss from the dissolved inorganic carbon (DIC) pool was via C1402 evasion to the overlying atmosphere. The next most important loss from the DIC pool was by photosynthetic fixation of inorganic carbon by epiimnetic phytoplankton. About half of the C14 thus incorporated into the particulate organic carbon (POC) pool was converted into soluble organic molecules which became part of the epilimnetic dissolved organic carbon-14 (DOC) pool. Since the amount of C14 lost to the sediments of the epilimnion, to the hypolimnion, and to periphyton biomass was not significant to the C14 mass balance over the duration of the experiment, the rate of gas exchange can be calculated by measuring the decrease in epilimnetic C14 inventory (DIC14 + POC14 + DOC14) over a specific time period. Using the stagnant boundary model and pCO2 values calculated from pH, temperature and DIC data a range of stagnant film thicknesses of 212-316 micrometers was obtained. To provide a check on the film thickness calculated from C14 inventories 10 mCi of Ra226 was also added to the epilimnion of L224. Measurements of Rn222, the gaseous daughter product of Ra226, allowed an independent estimate of the film thickness. The average value of 200 micrometers obtained in this way is consistent with that obtained for C1402 evasion. A simplified model was also constructed to describe the behavior of the POC and DOC pools. This model produced results in excellent agreement with the photosynthetic rate averaging 65 mg C/m/d measured using C14 and the Fee incubator technique. The model also suggests that only about 10% of the POC + DOC pool is active in the photosynthetic process on the time scale of 30 d. (Sims-ISWS)
W80-05413

DYNAMICS OF CADMIUM-STRESSED PLANKTON COMMUNITIES,
Argonne National Lab., IL. Radiological and Environmental Research Div.
J. S. Marshall, and D. L. Mellinger.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 403-414, March 1980. 7 Fig, 8 Tab, 40 Ref.

Descriptors: *Plankton, *Biological communities, *Cadmium, *Lakes, Effects, On-site investigations, Zooplankton, Phytoplankton, Dissolved oxygen, Algae, Water chemistry, Limnology, *Lake Michigan, *Canada, Cadmium stress.

Structural and functional responses of plankton communities to cadmium stress were studied during 1977 in Lake Michigan using small-volume (8 l) completely sealed enclosures, and in Canada's Experimental Lakes Area (ELA) Lake 223 using large-volume (150,000 l) open-surface enclosures. In Lake Michigan, reductions of the average abundance of microcrustaceans by cadmium were significantly greater in 'light' or shallow epilimnetic incubations than they were in 'dark' or deep epilimnetic incubations. Measurements of dissolved oxygen indicated that this interaction with light (depth) was an indirect effect due to a reduction of photosynthesis and primary production. Zooplankton density and species diversity were not significantly affected within 21 d by cadmium concentrations less than 0.6 and less than 1.2 micrograms Cd/l, respectively, whereas final dissolved oxygen concentration and percentage similarity (PS) of the crustacean zooplankton community were significantly reduced by greater than 0.2 micrograms Cd/l. In the ELA Lake 223 experiment, the reducing effect of cadmium on zooplankton density increased up to 31 d after Cd enrichment and then decreased, probably due to decreasing Cd concentrations in the water. Values of PS on day 24 for the ELA enclosures enriched with 1 and 3 micrograms Cd/l were within the 95% confidence limits for individual values predicted from a regression of PS on cadmium for the 21-d Lake Michigan experiments. (Sims-ISWS)
W80-05414

EXPERIMENTAL STUDY OF TRACE METAL CHEMISTRY IN SOFT-WATER LAKES AT DIFFERENT PH LEVELS,
Department of the Environment and Oceans, Winnipeg (Manitoba). Freshwater Inst.
T. A. Jackson, G. Kipphut, R. H. Hesslein, and D. W. Schindler.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 387-402, March 1980. 10 Fig, 4 Tab, 45 Ref.

Descriptors: *Lakes, *Acidity, *Effects, *Metals, Water chemistry, Hydrogen ion concentration, Trace elements, Sediments, Organic matter, Radioisotopes, Phosphorus, On-site investigations, Limnology, *Canada, Lake acidification, Acid precipitation, Acid rain.

The biogeochemistry of Hg, Zn, Co, Fe, Mn, Cr, V, Th, Ba, Cs, As, and Se in two soft-water lakes of the Canadian Shield was investigated by means of carrier-free gamma-emitting isotopes introduced into limnocorrals in which the pH of the water was varied from 6.8 to 5.1. The residence times of the radionuclides in the water were determined, and the partitioning of the nuclides among different metal-binding agents in the water and sediments was studied with the aid of membrane filtration, dialysis, solvent extractions, and fractionation on Sephadex columns. Metal behavior varied systematically with metal properties. Metals of high crystal field stabilization energy, high electronegativity, or small ionic radius were most readily scavenged by greater than 0.45 micrometer suspended particles and dispersed colloids in the water, disappeared most rapidly from the water column, and were preferentially accumulated by sedimentary binding agents, including organic substances. Which property of a metal had the dominant effect on metal behavior depended on environmental factors, such as the ambient pH and the nature of the binding agents. Thus, Hg was removed fairly rapidly from the water at pH 6.7-6.8 owing to its high electronegativity but was removed more slowly than any other metal at pH 5.1 owing to its large ionic radius. Acidification of lake water to pH 5.1 interfered with accumulation of Hg and other metals by organic ooze, probably owing in part to interference with the deposition or formation of the complexing agents with the 265 nm absorption band. Acidification also lowered the concentration of NaOH-extractable colloidal phosphate in the ooze but had no effect on NaOH-extractable orthophosphate content. (Sims-ISWS)
W80-05415

FATES OF METAL RADIOTRACERS ADDED TO A WHOLE LAKE: SEDIMENT-WATER INTERACTIONS,
Lamont-Doherty Geological Observatory, Palisades, NY.
R. H. Hesslein, W. S. Broecker, and D. W. Schindler.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 378-386, March 1980. 5 Fig, 8 Tab, 8 Ref. NSF OCE75-15105.

Descriptors: *Tracers, *Radioisotopes, *Sediments, *Metals, *Lakes, On-site investigations, Sampling, Cores, Isotope studies, Heavy metals, Water chemistry, Limnology, Sedimentology, *Canada, Metal budgets, Radioisotope budgets.

A whole-lake radiotracer experiment with the isotopes Se-75, Hg-203, Cs-134, Fe-59, and Co-60 was carried out in Lake 224 of the Experimental Lakes Area, northwestern Ontario. The results of the analyses of isotopes in the water column showed an exponential decrease in concentration with time. The rate of loss from the water column did not show dependence on the affinity of the isotope for suspended particulate material. This affinity ranged from 98% for Fe-59 to less than 1% for Cs-134 over the first 65 d. The major sink for isotopes lost from the water column was the sediments. Ratios of isotopes in the sediments showed that those isotopes associated with suspended particulates more easily reach deep sediments than those in dissolved form which were restricted by the thermocline to adsorption to epilimnion sediments. (Sims-ISWS)
W80-05416

EFFECTS OF ACIDIFICATION ON MOBILIZATION OF HEAVY METALS AND RADIONUCLIDES FROM THE SEDIMENTS OF A FRESHWATER LAKE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, R. H. Hesslein, R. Wagemann, and W. S. Broecker.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 373-377, March 1980. 3 Fig, 2 Tab, 13 Ref.

Descriptors: *Lakes, *Sediments, *Acidity, *Effects, *Heavy metals, *Radioisotopes, Isotope studies, On-site investigations, Aluminum, Manganese, Zinc, Iron, Mercury, Cobalt, Cesium, Pollutants, Acids, Metals, *Canada, Lake acidification, Acid precipitation, Acid rainfall.

Large (10 m) diameter enclosures were sealed to the sediments in 2-2.5 m of water in Lake 223. Two tubes were held at control pH (6.7-6.8), one was lowered to pH 5.7 and one to pH 5.1, using H2SO4. Aluminum, manganese, zinc, and iron were released from lake sediments at pH 5 and 6. Concentrations of zinc in the overlying water column exceeded 300 micrograms/l. Radioisotopes of several heavy metals added to the water of the enclosure showed the following: all metals were removed from the water at log-linear rates, with half-times of 5-25 d. Acidification caused several metals to become more soluble, including Fe-59, Co-60, Mn-54, and Zn-65. Solubility of V-48 and Hg-203 decreased with increasing acidity. Acidification also slowed the loss to sediments of Mn-54 and Zn-65. Losses of Ba-133, Se-75, Cs-134, and V-48 were more rapid under acid conditions. The fractions of any isotope retained by a 0.45-micrometer filter, activated charcoal, and mixed-bed ion exchange resin remained constant throughout the experiment at any given pH. (Sims-ISWS)
W80-05417

EFFECTS OF ARTIFICIAL ACIDIFICATION ON THE GROWTH OF PERIPHYTON,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
P. Muller.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 355-363, March 1980. 8 Fig, 5 Tab, 22 Ref.

Descriptors: *Lakes, *Acidity, *Effects, *Periphyton, Hydrogen ion concentration, Microorganisms, Primary productivity, Biomass, On-site investigations, Sampling, Biology, Limnology, *Canada, Lake acidification, Acid precipitation, Acid rainfall.

Acidification caused an increase in periphyton growth in large enclosures in the littoral zone of Lake 223. Diatomeae decreased in relative abundance above H(+) = 0.0000001 mol/l, and were replaced by filamentous Chlorophyta. The genus Mougeotia, dominant in many acidified Scandina-

vian lakes, was the most tolerant of high acidity. Fewer species and lower species diversity were observed at higher H(+). Although increases in standing crop were observed, there were no corresponding increases in production. The abundance of invertebrates and microbiota were also unaffected by hydrogen ion concentration. (Sims-ISWS)
W80-05418

EXPERIMENTAL ACIDIFICATION OF LAKE 223, EXPERIMENTAL LAKES AREA: BACKGROUND DATA AND THE FIRST THREE YEARS OF ACIDIFICATION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, R. Wagemann, R. B. Cook, T. Ruszczynski, and J. Prokopowich.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 342-354, March 1980. 18 Fig, 3 Tab, 34 Ref. NSF OCE78-20898.

Descriptors: *Lakes, *Acidity, *Effects, On-site investigations, Water chemistry, Hydrogen ion concentration, Bicarbonates, Dissolved oxygen, Iron, Copper, Aluminum, Ammonia, Turbidity, Sulfates, Sulfur, Chlorophyll, Limnology, *Canada, Lake acidification, Acid precipitation, Acid rainfall.

Sulfuric acid was used to add 1.60 eq/sq m of hydrogen ion H(+) to Lake 223 over a 3-yr period from 1976 to 1978, to simulate the effects of acid precipitation on chemical and biological characteristis of the lake. The pH of epilimnion water was lowered from 6.7-7.0 in 1976, to 6.0-6.2 in 1977, and to 5.7-5.9 in 1978. The effectiveness of acid addition at depleting alkalinity from the water column in the first 2 yr was 31-38%. As a result, the pH of the lake did not decrease as much as predicted from theoretical calculations. The low efficiency of acidification appeared to be due to generation of dissolved inorganic carbon (DIC) by sulfate reduction in anoxic regions of the hypolimnion. Sulfate reduction increased as addition of sulfuric acid caused the concentration of sulfate in the lake to increase. Mobilization of iron from hypolimnion sediments during anoxic periods caused DIC respired by decomposers to be accumulated as HCO3(-) to balance the Fe(+2) charge, buffering against acidification of the lake. Most of the reduced sulfur was precipitated from the lake as FeS. As a result, H2S in the hypolimnion was usually undetectable. Concentrations of ammonia, iron, manganese, zinc, and aluminum were higher in 1977 than in 1976. The transparency of the lake increased, although there was no apparent change in chlorophyll, dissolved color, dissolved organic carbon, or primary production. (Sims-ISWS)
W80-05419

WATER RENEWAL EFFICIENCY OF WATERSHED AND LAKE COMBINATIONS IN THE ELA REGION OF THE PRECAMBRIAN SHIELD,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2A.
W80-05420

HYPOLIMNION INJECTION OF NUTRIENT EFFLUENTS AS A METHOD FOR REDUCING EUTROPHICATION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, T. Ruszczynski, and E. J. Fee.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 320-327, March 1980. 3 Fig, 3 Tab, 36 Ref.

Descriptors: *Eutrophication, *Hypolimnion, *Nutrients, *Lakes, Phosphorus, Waste disposal, On-site investigations, Algae, Chlorophyll, Phytoplankton, Water pollution, Pollutants, Water pollution control, Dissolved oxygen, Limnology, *Canada, Experimental lakes.

Injection of nutrients into the anoxic hypolimnion of a small Precambrian Shield lake for 5 years caused less of a eutrophication problem than discharging nutrients into surface waters. Phytoplankton standing crop and production in the whole lake averaged only 10-21% of values in a nearby lake fertilized at the surface. Five-year averages for the epilimnion only were still lower: 5-8% of those in the surface-fertilized lake. Analysis of long-term trends in chlorophyll and nutrient concentrations revealed much slower rates of increase than in surface-fertilized lakes. (Sims-ISWS)
W80-05422

RELATIONSHIP AMONG OPTICAL TRANSMISSION, VOLUME REFLECTANCE, SUSPENDED MINERAL CONCENTRATION, AND CHLOROPHYLL A CONCENTRATION IN LAKE SUPERIOR,
Canada Centre for Inland Waters, Burlington (Ontario).
R. P. Bukata, J. H. Jerome, J. E. Bruton, and E. B. Bennett.
Journal of Great Lakes Research, Vol 4, No 3-4, p 456-461, December 1978. 5 Fig, 9 Ref.

Descriptors: *Turbidity, *Suspended solids, *Chlorophyll, *Model studies, *Lake Superior, Mathematical models, On-site data collections, Light, Reflectance, Optical properties, Attenuation, Lakes, Limnology, Optical transmission.

A semiempirical model was described wherein both the suspended inorganic and organic (represented by suspended mineral and chlorophyll a) concentrations of a water mass may be determined by simultaneous measurements of the optical transmission and near-surface volume reflectance of the water column. Predictions of the chlorophyll concentrations resulting from the optical model were compared with chlorophyll measurements taken from Great Lakes cruises. Excellent agreement was observed for the waters of Lake Superior while very poor agreement was seen for the more optically complex water masses of Lakes Ontario and Erie. Comparisons were also made between predicted and measured values of suspended mineral concentrations. (Sims-ISWS)
W80-05423

IN SITU MEASUREMENTS OF PORE WATER DIFFUSION COEFFICIENTS USING TRITIATED WATER,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2F.
W80-05424

RELATIONSHIPS BETWEEN DIPTERAN EMERGENCE AND PHYTOPLANKTON PRODUCTION IN THE EXPERIMENTAL LAKES AREA, NORTHWESTERN ONTARIO,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
I. J. Davies.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 523-533, March 1980. 6 Fig, 3 Tab, 47 Ref.

Descriptors: *Phytoplankton, *Aquatic insects, *Diptera, *Lakes, Eutrophication, Primary productivity, Biomass, Sampling, Data processing, Phosphorus, Nutrients, Photosynthesis, Biology, Limnology, *Canada.

Dipteran emergence was monitored at the Experimental Lakes Area (ELA) between 1973 and 1977 in seven lakes of different trophic status. The data were used to develop a number of equations which related the quantity and spatial distribution of average annual emergence to lake productivity. These models explained greater than 94% of the variation in mean emergent biomass among lakes or greater than 76% of the variation in numbers of emergent Diptera in terms of phytoplankton production of phosphorus loading. On average, ELA lakes produced 40.8 dipteran adults (9 mg dry weight) per gram carbon fixed by phytoplankton. A single equation for all lakes predicts the surface distribution of emergent biomass, relative to lake depth at any location, from vertical profiles of phytoplankton production. The mean size of dipteran adults was related to lake depth at the point of emergence and average phytoplankton production. An empirical model which used data on the vertical profile, and lake average, of phytoplankton production was developed to predict the number of Diptera emerging from each depth. The maximum depth of emergence was related to depth of the euphotic zone and average phytoplankton production in each lake. Initial tests suggested that the models may provide useful predictions of dipteran emergence for a wider spectrum of lakes. (Sims-ISWS)
W80-05425

IMPORTANT FACTORS FOR ESTIMATING ANNUAL PHYTOPLANKTON PRODUCTION IN THE EXPERIMENTAL LAKES AREA,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
E. J. Fee.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 513-522, March 1980. 5 Fig, 4 Tab, 18 Ref.

Descriptors: *Phytoplankton, *Primary productivity, *Lakes, *Model studies, Mathematical models, Computer models, Light, Plankton, Incubation, Sampling, Hypolimnion, Chlorophyll, Photosynthesis, Limnology, *Canada.

Annual phytoplankton growth rates from 21 lakes in the Experimental Lakes Area (ELA) for the 4-yr period 1973-76 were reported. The coefficient of variation of production in most lakes over this period was about 20%. This variability was the same for both control and experimental lakes. Subthermocline populations were quantitatively unimportant in eutrophied basins, but up to 50% of annual production occurred in hypolimnion chlorophyll peaks in some transparent control lakes. The exact details of chlorophyll distribution as monitored with an in vivo fluorometer are unnecessary for accurate measurements of production, even in lakes having hypolimnion chlorophyll peaks. Annual production rates were about 80% of the rates predicted with simulated cloudless weather. The common practice of not correcting production estimates for basin morphometry when reporting areal production rates resulted in overestimation of productivity by roughly 20%. The results indicated several ways for simplifying the numerical primary production model. (Sims-ISWS)
W80-05426

DENITRIFICATION IN LAKE 227 DURING SUMMER STRATIFICATION,
Manitoba Univ., Winnipeg. Dept. of Microbiology.
Y. K. Chan, and N. E. R. Campbell.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 506-512, March 1980. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Lakes, *Stratification, *Surveys, *Water quality, Summer, On-site investigations, Nitrates, Water sampling, Analysis, Water chemistry, Nitrogen, Dissolved oxygen, On-site tests, *Denitrification, Spatial distribution, Profiles, Epilimnion, Sediments, Sediment-water interfaces, *Canada, Nitrogen budget.

In situ denitrification in Lake 227 in northwestern Ontario was assayed by using 15N-labeled NO3(-) during summer stratification periods in 1973, 1974, and 1975. Dissolved oxygen and NO3(-) concentrations were the main factors controlling denitrification in the water column and in sediments. The epilimnetic sediment-water interface was a more significant site of natural denitrification when compared to the oxygen-limiting (dissolved oxygen less than 0.2 mg/l) thermocline and the anoxic hypolimnion. Epilimnetic sediment denitrification rates averaged about 15 mg N/sq m/d. Nearly all of the NO3(-) that mixed into the surficial sediments was denitrified. Alone, epilimnetic denitrification removed 1.4% of the NO3(-) added annually. Below the euphotic zone, sediments would provide an efficient sink for NO3(-)-N without simultaneous initiation of eutrophication. (Humphreys-ISWS)
W80-05427

COMPARISON OF THE NITROGEN-15 UPTAKE AND ACETYLENE REDUCTION METHODS FOR ESTIMATING THE RATES

OF NITROGEN FIXATION BY FRESHWATER BLUE-GREEN ALGAE,
B. M. Graham, R. D. Hamilton, and N. E. R. Campbell.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 488-493, March 1980. 1 Fig, 4 Tab, 24 Ref.

Descriptors: *Nitrogen, *Algae, *Nitrogen fixation, *Chemical analysis, *Analytical techniques, Lakes, Sampling, Nutrients, Nitrogen compounds, Absorption, Data processing, Regression analysis, Limnology, *Canada, Acetylene reduction, Nitrogen-15 uptake.

The relationship of acetylene reduction to nitrogen-15 uptake was investigated using blue-green algal populations in three lakes in the Experimental Lakes Area, northwestern Ontario. Nitrogen fixation rates, as estimated with both techniques, were compared, and acetylene to nitrogen ratios were determined. Lake ratios ranged from 6.3 to 9.1 moles of acetylene reduced per mole of nitrogen fixed varying from sample to sample and also with the method of calculation. Explanations of the discrepancies between theoretical and empirical ratios were discussed; these included hypotheses of excretion of assimilated nitrogen-15 labeled material and interference from nitrogenase-mediated hydrogen production. (Sims-ISWS)
W80-05428

RADIOCHEMICAL ANALYSIS OF ORTHOPHOSPHATE CONCENTRATIONS AND SEASONAL CHANGES IN THE FLUX OF ORTHOPHOSPHATE TO SESTON IN TWO CANADIAN SHIELD LAKES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
S. N. Levine, and D. W. Schindler.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 479-487, March 1980. 5 Fig, 3 Tab, 21 Ref.

Descriptors: *Phosphorus compounds, *Lakes, *Chemical analysis, *Analytical techniques, Phosphorus, Phosphates, Pollutants, Pollutant identification, Sampling, Nutrients, Fertilizers, Chlorophyll, Algae, Limnology, *Canada, *Orthophosphate.

Seasonal changes in the concentration and dynamics of phosphate-phosphorus were studied in two small lakes, one oligotrophic and one artificially eutrophied. Because the molybdate blue phosphate technique frequently overestimates phosphate concentrations, three radiochemical assays were used. One, involving Sephadex fractionation, was unsatisfactory because of the long period required for high molecular weight phosphorus fractions to reach isotopic equilibrium. The second method was unusable both for epilimnion waters within the Experimental Lakes Area, because of its low sensitivity, and for hypolimnion waters, due to interference from nonphosphate compounds. The third method, Rigler's bioassay, indicated that PO4-P in both lakes seldom exceeded 0.1 microgram/l, even under anoxic conditions. Organisms, and not mineral reactions, appeared to regulate the phosphate concentration at all depths in the lakes. (Sims-ISWS)
W80-05429

RELATIVE IMPORTANCE OF NANNOPLANKTON IN LAKE SUPERIOR PHYTOPLANKTON BIOMASS AND COMMUNITY METABOLISM,
Canada Centre for Inland Waters, Burlington (Ontario).
M. Munawar, I. F. Munawar, L. R. Culp, and G. Dupuis.
Journal of Great Lakes Research, Vol 4, No 3-4, p 462-480, December 1978. 8 Fig, 9 Tab, 50 Ref.

Descriptors: *Phytoplankton, *Nannoplankton, *Algae, *Lake Superior, *Great Lakes, On-site investigations, Sampling, Data processing, Biomass, Biological communities, Particle size, Diatoms, Aquatic productivity, Primary productivity, Nutrients, Biology, Lakes, Limnology.

The qualitative and quantitative significance of nannoplankton in Lake Superior in terms of taxonomy and primary production was studied during 1973. The size analysis of algae into netplankton (greater than 64 micrometers) and nannoplankton (less than 64 micrometers) and its various size fractions (less than 5; 5-10; 10-20; 20-44; 44-64 micrometers) was based on microscopic enumeration and measurements by means of the Utermoehl procedure. Primary production experiments and their subsequent fractionation by means of Carbon-14 technique were undertaken to determine the relative photosynthetic rate of different size fractions of algae. Production/biomass quotients (activity coefficients) were computed and related to species composition. On a lakewide basis the nannoplankton was the major component of the algal biomass contributing from 57-80% and comprised mainly of Cryptophyceae, Diatomeae, and Chrysophyceae. Nannoplankton were also abundant vertically. The nannoplankton also dominated the community metabolism by contributing, on an average, 87-94% to the primary production as demonstrated by Carbon-14 fractionation experiments. The smallest size fraction of the uptake experiments (less than 10 micrometers), consisting of microalgae and ultraplankton, was the most active fraction photosynthetically, contributing 72% to the total production. The Lake Superior algae were rich in chlorophyll content and were relatively efficient when compared to the lower Great Lakes as indicated by high Production/Biomass (P/B) and chlorophyll/biomass ratios. The cryptomonad species like Rhodomonas minuta, Cryptomonas erosa, C. marsonii, and the diatom Asterionella formosa showed extremely high P/B quotients. These results emphasize the importance of adopting the Utermoehl technique and a fractionation approach both in taxonomic and physiological research to focus on the complex nannoplankton ecology which clearly plays a key role in population dynamics. (Sims-ISWS)
W80-05434

USE OF BENTHOS IN LAKE MONITORING,
Swedish Environment Protection Board, Stockholm.
T. Wiederholm.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 537-547, March 1980. 8 Fig, 2 Tab, 30 Ref.

Descriptors: *Lakes, *Monitoring, *Aquatic environment, *Water quality, Benthos, chlorophyll, Lead, Biological communities, Bioindicators, Nutrients, Eutrophication, Phosphorus, Methodology, On-site investigation, Oligochaetes, *Sweden.

The paper discussed the rationale behind the use of biological variables in environmental monitoring of lakes, as well as the principles of variable selection and the limitations of data usability. Profundal benthic communities were suggested to be an integral measure of autotrophic and heterotrophic lake processes. Measures of community structure and their relationship to morphometric and edaphic factors were presented and discussed, including indicator species/communities, diversity/species richness, oligochaete/chironomid ratio, and oligochaete abundance. It was demonstrated that each of these measures could be related to lake characteristics such as concentration of phosphorus or chlorophyll. To reach a logical ordering of data from different types of lakes or from different depths in one lake, it is necessary, however, to include the depth factor in some way. This was done simply by dividing or multiplying primary data by the factual sampling depth, depending on whether the size of a specific community measure is positively or negatively correlated with depth. Although rather crude, this operation was felt to be intuitively sound in that it accounted for the combined effect of important factors such as food supply (greater degree of mineralization but more accumulation of sediment at greater depth), predation pressure (generally declining with increasing depth), and unfavorable abiotic factors (for example, oxygen deficit). (Humphreys-ISWS)
W80-05480

TRACE METALS IN HUMIC AND FULVIC ACIDS FROM LAKE ONTARIO SEDIMENTS,
Canada Centre for Inland Waters, Burlington (Ontario); and National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W80-05487

WHOLE-LAKE MODEL FOR THE DISTRIBUTION OF SEDIMENT-DERIVED CHEMICAL SPECIES,
Lamont-Doherty Geological Observatory, Palisades, NY.
R. H. Hesslein.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 552-558, March 1980. 5 Fig, 1 Tab, 21 Ref. NSF OCE75-15105.

Descriptors: *Sediments, *Lakes, *Lake sediments, *Chemistry, Methane, Carbon dioxide, Ammonia, Nitrogen, Nutrients, Oxygen, Dissolved oxygen, Model studies, Mathematical models, Limnology, Sedimentology, Sediment-water interactions.

The distribution of CH4, Sigma CO2, and NH3-N below the thermocline of Lake 227 can be reproduced using a simple numerical model. The model uses a constant vertical eddy diffusion coefficient and assumes the sediments to be the sole source of the chemical species. Analogs dependent on oxygen concentration can effectively represent conditions at the interface of the modeled region and the shallower depths in the lake. The best fit value for the vertical eddy diffusion coefficient is 0.0031 sq cm/s. This is in good agreement with other independent measurements of this phenomena. The best fit fluxes of CH4, dissolved inorganic carbon, and NH3-N are respectively: 0.013 mol/sq m/d, 0.0075 mol/sq m/d, and 0.00165 mol/sq m/d. The flux of methane is similar to that found in other small productive northern lakes, and the ratio of CH4:Sigma CO2 production of 1.73 falls in the range of values established for fermentation of mixed organic materials and sediments. The flux of Sigma C02 is 50-75% of the bicarbonate flux (0.010-0.015 mol/sq m/d) found previously in Linsley Pond, Connecticut. (Sims-ISWS)
W80-05488

NITROGEN FIXATION IN CANADIAN PRECAMBRIAN SHIELD LAKES,
Manitoba Univ., Winnipeg. Dept. of Microbiology.
R. J. Flett, D. W. Schindler, R. D. Hamilton, and N. E. R. Campbell.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 494-505, March 1980. 8 Fig, 6 Tab, 36 Ref.

Descriptors: *Nitrogen, *Nitrogen fixation, *Plankton, *Algae, *Lakes, On-site investigations, Laboratory tests, Model studies, Computer models, Nutrients, Fertilizers, Eutrophication, Biomass, Sediments, Cores, Limnology, Acetylene reduction, Nitrogen-15 uptake.

Acetylene reduction assays in the water columns of several artificially eutrophied lakes in the Experimental Lakes Area revealed that nitrogen fixation by planktonic blue-green algae could supply a significant portion of the nitrogen income to these lakes. In situ 15N2 uptake experiments in one lake indicated that nitrogen fixation was proceeding at a slow rate in the low oxygen region of the thermocline, probably via methane-oxidizing bacteria. Other 15N2 uptake experiments in the littoral sediments of an oligotrophic lake failed to detect nitrogen fixation. Generally, algal nitrogen fixation occurred in Shield lakes that were subject to total N:total P loading ratios (wt/wt) of less than approximately 10. This suggested that in these lakes phosphorus removal from loading is the best technique for eutrophication abatement and that nitrogen removal, when applied by itself, may be detrimental because it could encourage bloom formation of nitrogen-fixing blue-green algae. (Sims-ISWS)
W80-05489

ADVECTIVE CONTROL OF NUTRIENT DYNAMICS IN THE EPILIMNION OF A LARGE RESERVOIR,
Cornell Univ., Ithaca, NY. Dept. of Natural Re-

sources.
S. P. Gloss, L. M. Mayer, and D. E. Kidd.
Limnology and Oceanography, Vol 25, No 2, p 219-228, March 1980. 8 Fig, 2 Tab, 26 Ref. NSF AEN72-03469, GI-34831.

Descriptors: *Nutrients, *Reservoirs, *Phytoplankton, *Advection, Epilimnion, Sampling, Silica, Nitrates, Nitrogen, Phosphorus, Conductivity, Turbidity, Water quality, Limnology, Biology, *Lake Powell(UT-AZ).

Silica, nitrate, total and dissolved phosphorus, and conductivity were measured during spring and summer in Lake Powell, Utah-Arizona. Phytoplankton productivity was also determined. Conductivity was used as a tracer for delineating the advective influence of inflows from the Colorado and San Juan Rivers on nutrient delivery and distribution in the reservoir. High spring runoff (1,000-2,000 cu m/s) enters the lake essentially as an overflow and dominates the nutrient cycle in the epilimnion. The interaction of advective nutrient delivery and high turbidity controls the distribution of phytoplankton productivity and nutrient depletion. (Sims-ISWS)
W80-05491

RECENT SEDIMENTATION AND ITS RELATIONSHIP WITH PRIMARY PRODUCTIVITY IN FOUR WESTERN WASHINGTON LAKES,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W80-05492

VERTICAL DIFFUSION RATES DETERMINED BY TRITIUM TRACER EXPERIMENTS IN THE THERMOCLINE AND HYPOLIMNION OF TWO LAKES,
Washington Univ., Seattle. Dept. of Geological Sciences.
P. D. Quay, W. S. Broecker, R. H. Hesslein, and D. W. Schindler.
Limnology and Oceanography, Vol 25, No 2, p 201-218, March 1980. 11 Fig, 3 Tab, 48 Ref. NSF OCE77-01430, OCE75-15105.

Descriptors: *Diffusion, *Lakes, *Tracers, *Tritium, Turbulence, Mixing, On-site investigations, On-site data collections, Measurement, Thermocline, Hypolimnion, Stratification, Stability, Density, Water temperature, Salts, Gases, Limnology, Vertical diffusion.

Vertical diffusion rates (K sub z) were determined by measuring for several weeks the vertical spread of an injection of tritiated water into the thermoclines and hypolimnia of Lake 227 and Lake 224 in the Experimental Lakes Area (ELA) of northwestern Ontario. K sub z values of 0.00005 and 0.0008 sq cm/s were determined from the tracer experiments in the thermoclines of L227 and L224; in the hypolimnia, similar K sub z determinations of 0.0017 and 0.018 sq cm/s are 20-30 times greater than the thermocline rates. Vertical diffusion rates of heat were determined over the same time and depth intervals as the tracer experiments. In each lake, heat is diffusing vertically faster than mass in the thermocline and at more equal rates in the hypolimnion. The low K sub z values and the greater diffusion rate of heat than mass (tritium) indicate that molecular diffusion is important in determing the rate of vertical transport in the thermoclines of these highly stratified lakes. Vertical eddy diffusion rates (K sub z prime) determined by the tracer experiments show an inverse proportionality to the static stability of the water column (N sq), such that K sub z prime is proportional to (N sq) to the (-0.8) power. However, K sub z prime values determined by measuring the hypolimnetic heating rates of eight ELA lakes (including L227 and L224) and three lakes outside ELA indicate that K sub z prime is proportional to (N sq) to the (-0.44) power. These observations suggest that in the absence of large shear where K sub z prime less than 0.01 sq cm/s the vertical diffusion rates of mass and heat show different inverse correlations to the static stability of the water column. (Sims-ISWS)
W80-05493

GEOCHEMICAL AND MICROBIAL ASPECTS OF VOLO BOG, LAKE COUNTY, ILLINOIS,
Illinois Univ. at Urbana-Champaign.
J. B. Risatti, Jr.
Ph.D. Dissertation, 1978. 106 p.

Descriptors: *Bogs, *Illinois, *Geochemistry, Wetlands, History, Humic acids, Decomposing organic matter, Methane, Aquatic bacteria, Distribution factors.

Volo Lake formed about 11,000 years B.P. The bog did not undergo a gradual, discontinuous filling of the original lake with sediments but may have dried entirely or lacked an open water area on at least two occasions. Throughout its history, the bog appears to have been sustained by groundwater which is also the source of many metals found in the peats. Humic acids from the bog show little change in either concentration with depth or in spectral characteristics. It also appears that humic acids have been formed in the bog anaerobically as well as aerobically and that degradation of compounds other than lignins may have produced materials for humic acid formation. Numbers of cellulolytic bacteria decreased with depth and decreasing cellulose; limiting factors for the cellulolytic bacteria appear to be not only in the presence of cellulose, but also perhaps its availability. In the lower levels of the bog, temperatures of 8-9.5 degrees centigrade are important in slowing the decomposition rate. Methane producing bacteria were cultured and enumerated to a depth of 8.6 meters in the bog. (Steiner-Mass)
W80-05632

INVESTIGATION OF THE HYDROLOGICAL BALANCE IN A PEAT SWAMP,
Brussels Univ., (Belgium).
For primary bibliographic entry see Field 2F.
W80-05633

AUTHIGENIC MINERALS OF SULFUR IN MODERN PEAT BOGS OF THE URALS,
Institute of Geology and Geochemistry, Sverdlovsk (USSR).
For primary bibliographic entry see Field 2K.
W80-05638

METAL CONTENT OF SPHAGNUM MOSSES FROM TWO NORTHERN CANADIAN BOG ECOSYSTEMS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2I.
W80-05640

PRELIMINARY MUSKEG (PEATLAND) INVENTORY OF THE PROVINCE OF NEW BRUNSWICK,
New Brunswick Dept. of Natural Resources, Fredericton.
For primary bibliographic entry see Field 7B.
W80-05641

GROWTH MEASUREMENTS OF FIVE SPHAGNUM SPECIES IN SOUTH NORWAY,
Oslo Univ. (Norway). Botanical Lab.
For primary bibliographic entry see Field 2I.
W80-05646

RELATION OF CHEMICAL DISCHARGE OF RIVERS TO THE SWAMPY CHARACTER OF DRAINAGE AREAS,
Akademiya Navuk BSSR, Minsk. Inst. Geokhimii i Geofiziki.
V. A. Kovalev, A. L. Zhukhovitskaya, and A. A. Sokolovskaya.
Lithology and Mineral Resources, Vol 9, No 4, p 393-398, May, 1975. 3 Fig, 6 Tab, 9 Ref.

Descriptors: *Swamps, *Geomorphology, *Water quality, Wetlands, Ecological effects, Russia, Sediments, Rivers, Ion transport, Dissolved solids, Environmental effects, Iron, Silicon, Aluminum.

On the basis of the rivers of Belorussia, it was shown that with increased swamp development (size) the quantity of mechanical suspension declines, the transfer of iron, silicon, aluminum, and other elements in dissolved forms increases, and the total and relative iron content of surface waters also increases. (Steiner-Mass)
W80-05658

WETLAND CLASSIFICATION AND MAPPING IN WESTERN TENNESSEE,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7B.
W80-05664

SUBDIVISION AND ABSOLUTE GEOCHRONOLOGY OF THE HOLOCENE PEAT BOGS OF KAMCHATKA,
Akademiya Nauk SSSR, Moscow. Geologicheskii Inst.
O. A. Braytseva, I. S. Yevteyeva, Y. G. Lupikina, and L. Sulerzhitskiy.
Doklady Akademii, Nauk SSSR, Vol 208, No 4, p 84-87, 1973. 3 Fig, 11 Ref.

Descriptors: *History, *Palynology, *Bogs, Succession, Wetlands, Peat, Pollen, Diatoms, Radioactive dating, Russia.

A comprehensive study was made on some young peat bogs of the Kamchatka Peninsula, USSR, to obtain data on their spores, pollen, diatoms, and radiocarbon age. Consequently, it is possible to subdivide the Holocene of Kamchatka into various time intervals that differed in their types of plant cover and climatic conditions. (Steiner-Mass)
W80-05665

PEAT DEPTH OF SIERRA NEVADA FENS, AND PROFILE CHANGES FROM 1958 TO 1972 IN MASON FEN,
California Univ., Berkeley. Dept. of Forestry and Conservation.
D. C. Erman.
Great Basin Naturalist, Vol 36, No 1, p 101-107, March, 1976. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *California, *Fens, *History, Wetlands, *Peat, Soil profiles, Soil surveys.

Peat cores along transects of seven minerotrophic peatlands (fens) in the Sagehen Creek basin were made in 1972. The areas were all shallow, sloping peatlands from 67 to 206 cm in maximum depth. Cores from one fen contained layers of charcoal and clay that suggested fire followed by fen regneration. Profiles from Mason Fen suggested that the peat mass was moving downslope, creating splits and ridges with surface pools at right angles to the slope. Comparison of a profile made in 1958 and 1972 showed further evidence of downslope mass movement and expansion of the surface area. (Steiner-Mass)
W80-05666

PHOTOSYNTHETICALLY ACTIVE RADIATION IN A STAND OF PHRAGMITES COMMUNIS TRIN. I. DISTRIBUTION OF IRRADIANCE AND FOLIAGE STRUCTURE,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
Photosynthetica, Vol 7, No 1, p 8-17, 1973. 11 Fig, 3 Tab, 22 Ref.

Descriptors: *Marsh plants, *Energy conversion, *Leaves, Wetlands, Photosynthesis, Light intensity, Plant physiology, Primary productivity, Structure.

The relative proportions of reflected, direct and diffuse photosynthetically active radiation (PhAR) in a littoral stand of Phragmites communis Trin. are reported, as well as the transmission, reflection and absorption of reed leaves. The geometrical structure of the reed stand, determined by the vertical distribution of leaf area and by the distribution of leaf inclination and orientation is analyzed as a time-dependent structure. (Steiner-Mass)
W80-05667

PALYNOLOGY OF HOLOCENE PEAT BOGS FROM THE CENTRAL VENEZUELAN ANDES,
Instituto Venezolano de Investigaciones Cientificas, Caracas. Centre de Ecologia.
M. L. Salgado-Labouriau, and C. Schubert.
Palaeogeography, Palaeoclimatology, Palaeoecology, Vol 19, p 147-156, 1976. 6 Fig, 17 Ref.

Descriptors: *Bogs, *History, *Palynology, Wetlands, Peat, Pollen, Spores, Environmental effects, Venezuela.

A sequence of six Holocene peats in a river terrace in Paramo de La Culata was studied and compared with present-day peat deposits. The pollen analysis has shown that this region has been a humid paramo since about 7500 years B.P. At about 6000 years ago, pollen-rain input greatly decreased, reflecting poor local and adjacent vegetation. This is interpreted as representing a lowering of the average temperature of the region during a short time. (Steiner-Mass)
W80-05675

2I. Water In Plants

A SURVEY OF RIPARIAN FOREST FLORA AND FAUNA IN CALIFORNIA,
California Univ., Davis.
W. G. Roberts, J. G. Howe, and J. Major.
In: Riparian Forests in California, Their Ecology and Conservation, Institute of Ecology, Publication No 15, California University, Davis, p 3-19, May 1977. 2 Fig, 4 Tab, 39 Ref.

Descriptors: *Surveys, *Riparian plants, *California, *Wildlife, Forests, Census, Distribution patterns, Wildlife habitat, Mammals, Reptiles.

Woody plants of the riparian woodlands of the Central Valley, North Coast, South Coast, Palm Oases, Deserts, and Northeastern Valleys, California, are listed. The first four types are typically Californian while the remaining three are more closely related to forests of adjacent states and Mexico. A partial list of the mammals, reptiles, amphibians, and butterflies inhabiting riparian habitats is given. (See also W80-05606) (Steiner-Mass)
W80-05607

GEOLOGIC HISTORY OF THE RIPARIAN FORESTS OF CALIFORNIA,
California Univ., Davis. Dept. of Botany.
R. Robichaux.
In: Riparian Forests in California, Their Ecology and Conservation, Institute of Ecology Publication No 15, California University, Davis, p 21-34, May, 1977. 5 Fig, 2 Tab, 55 Ref.

Descriptors: *California, *Riparian plants, *History, Forests, Distribution patterns, Trees, Tertiary period, Succession.

The history of California's lowland riparian community follows the principles for community evolution in general in the western United States during the late Tertiary. The modern community includes taxa of different floristic sources. Acer negundo, Alnus rhombifolia, Fraxinus latifolia, Quercus lobata, and Salix lasiandra represent an 'Arcto-Tertiary' or northern element, while Platanus racemosa, Populus fremontii, and Salix lasiolepis represent a 'Madro-Tertiary' or southern element. The modern community is a relatively impoverished representative of richer, more generalized ancestral communities that included taxa related to modern species found only in the southwestern U.S. and northern Mexico (species of Acer, Celtis, Juglans, Persea, and Sapindus), the eastern U.S. (species of Carya, Liquidambar, Magnolia, Nyssa, and Ulmus), and eastern Asia (species of Glyptostrobus, Ulmus, and Zelkova). These exotic taxa were eliminated from the ancestral communities by the major climatic changes of the later Tertiary. Several of the dominant species in the modern community have apparently been associated, as ancestral forms in ancient communities, for a time span of nearly 20 million years. (See also W80-05606) (Steiner-Mass)
W80-05608

RIPARIAN FORESTS OF THE SACRAMENTO VALLEY, CALIFORNIA,
California Univ., Davis. Dept. of Geography.
K. Thompson.
In: Riparian Forests in California, Their Ecology and Conservation, Institute of Ecology Publication No 15, California University, Davis, p 35-38, May 1977. 6 Ref.

Descriptors: *California, *Riparian plants, *History, Forests, Rivers, Levees, Trees, Sacramento Valley(CA).

Although edaphic and biotic influences precluded trees from most of the Sacramento Valley in its pristine condition, the riparian lands (mainly natural levees) supported a flourishing tree growth--valley oak, sycamore, cottonwood, willow, and species. Today, parts of both banks of the Sacramento and its tributaries are bordered by many shrunken remnants of the once extensive riparian woodland. The same tree species mentioned in the historical records still grow on the river banks, natural levees, and channel ridge. Typically, cottonwoods and willows predominate on the immediate stream banks, whereas valley oaks are spread irregularly over the natural levees farther away from the river. Instead of a strip measurable in miles, the forested zones are now only yards deep and discontinuous. Generally, the remaining fragments form a belt less than 100 yards wide and are largely confined to bank slope of streams and sloughs, abandoned meanders, and on the river side of artificial levees. (See also W80-05606) (Steiner-Mass)
W80-05609

RIPARIAN VEGETATION AND FLORA OF THE SACRAMENTO VALLEY,
California Univ., Davis.
S. G. Conard, R. L. MacDonald, and R. F. Holland.
In: Riparian Forests in California, Their Ecology and Conservation, Institute of Ecology Publication No 15, California, University, Davis, p 47-55, May 1977, 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Distribution patterns, *Riparian plants, *California, Forests, Wetlands, Freshwater marshes, Spatial distribution, Succession.

The vegetation of any riparian site reflects the history of flooding, aggradation, and erosion by the river. The major riparian plant communities can be aligned along several topographic gradients. The low, recent gravel bar deposits are dominated by introduced annuals and low perennials. As the bars become more removed from the river and begin to stabilize, they are colonized by thickets of tall shrubs and tree saplings. Riparian forests will become established on lower terrace deposits or as flood frequency decreases. These woodlands gradually thin out and grade into valley grassland vegetation with increasing distance from the river. Oxbows and over-flow basins are characterized by a series of hydric communities. Freshwater marshes in low, wet areas are dominated by Scirpus acutus. On higher ground, these are succeeded by shrubs such as Cornus stolonifera and Cephalanthus occidentalis. These shrub-dominated habitats appear transitional to typical Populus fremontii dominated riparian forests on higher grounds. (See also W80-05606) (Steiner-Mass)
W80-05611

THE VALLEY RIPARIAN FORESTS OF CALIFORNIA: THEIR IMPORTANCE TO BIRD POPULATIONS,
D. A. Gaines.
In: Riparian Forests in California: Their Ecology and Conservation, Institute of Ecology Publication No 15, California University, Davis, p 57-85, May 1977, 5 Fig, 3 Tab, 67 Ref.

Descriptors: *California, *Birds, *Riparian waters, Forests, Wildlife habitat, Temporal distribution, Song birds, Migration, Wildlife.

The density, diversity, foraging guilds, and other characteristics of the riparian avifauna were obtained from census data taken from riparian forest sites in the Sacramento Valley, California. The survey is divided into five sections: (1) a brief description of the habitat, (2) a discussion of the breeding avifauna, (3) a discussion of the wintering avifauna, (4) a discussion of migration, and (5) a reflection on the plight of the yellow-billed Cuckoo. (See also W80-05606) (Steiner-Mass)
W80-05612

HABITATS OF NATIVE FISHES IN THE SACRAMENTO RIVER BASIN,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
For primary bibliographic entry see Field 6G.
W80-05613

SUBSTRATE COMPETITION BETWEEN A SALT MARSH DIATOM AND A BACTERIAL POPULATION,
City Coll., New York. Dept. of Biology.
N. M. Saks, and E. G. Kahn.
Journal of Phycology, Vol 15, p 17-21, 1979. 2 Tab, 25 Ref.

Descriptors: *Competition, *Diatoms, *Marine bacteria, *Salt marshes, Muck soils, Wetlands, Bacteria, Marshes, Amino acids, Aquatic microorganisms.

Cylindrotheca closterium Ehrenberg, a benthic marine diatom, competes successfully with Aeromonas sp. a bacterium from the same environment, for low molecular weight organic substrates when they are presented at natural concentrations (1-10 micron M). In short term (1 h) experiments, the uptake of mannose by C. closterium was enhanced in light. Seventy percent of the total uptake of mannose by both species was effected by C. closterium over a 1 h period of light. The diatom population was also competitive in darkness. The algal portion of glucose uptake over 1 h was 71% when both populations were given the substrate initially. Percentages of total amino acid uptake for C. closterium ranged from 33% glycine in light to 73% leucine in darkness when both species were given substrate initially. Cylindrotheca had smaller percentages of glucose and aspartic acid total uptake in competition experiments run to stationary phase (10 days). (Steiner-Mass)
W80-05616

AN ANALYSIS OF ANNUAL GROWTH AND PRODUCTIVITY OF JUNCUS ROEMERIANUS SCHEELE AND SPARTINA ALTERNIFLORA LOISEL IN COASTAL ALABAMA,
Alabama Univ., Birmingham.
J. P. Stout.
Ph.D. Dissertation, 1978. p 106.

Descriptors: *Coastal marshes, *Alabama, *Primary productivity, *Marsh plants, Wetlands, Standing crop, Salt marshes, Biomass, Marshes, Grasses, Plant growth.

Mean annual aboveground biomass was 1,449 g/sq m for Juncus roemerianus and 1,030 g/sq m for Spartina alterniflora. Significant seasonal variation in above-ground standing crop was observed for both species. Belowground biomass did not vary during the study and averaged 4,558 g/sq m for Juncus and 3,595 g/sq m for Spartina. Annual aboveground net primary productivity of Spartina ranged from 657-2,029 g/sq m/year and 1,180-3,078 g/sq m/year for Juncus, depending on the calculation methods. Annual belowground net primary productivity ranged from 5,395-6,218 g/sq m/year for Spartina and 4,423-7,578 g/sq m/year for Juncus. No correlation was found between levels of aboveground and belowground productions. (Steiner-Mass)
W80-05618

FUNGI FROM SPARTINA ALTERNIFLORA IN RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Botany.
R. V. Gessner, and R. D. Goos.
Mycologia, Vol 65, p 1296-1301, 1973. 1 Tab, 15 Ref.

Descriptors: *Marine fungi, *Marsh plants, *Rhode Island, Wetlands, Marine microorganisms, Marshes, Fungi, Microorganisms.

Eighteen Ascomycetes, twelve Deuteromycetes, and two Basidiomycetes were collected from Spartina alterniflora plants in Rhode Island salt marshes. Marine and terrestrial species occurred in approximately equal numbers. Alternaria spp., Leptosphaeria discors, Leptosphaeria typharum, Phoma spp., Septoria spp., and Sphaerulina pedicellata were the most common species being present in 41-86% of the collections. Living plants supported a substantial fungal growth, especially S. pedicellata. Dead culms were invaded by saprobic Ascomycetes and occasionally lignicolous species. Estuarine salinity did not appear to affect the occurrence of the predominate fungi. (Steiner-Mass)
W80-05620

LONG-TERM EFFECTS OF MANIPULATING LIGHT INTENSITY AND NUTRIENT ENRICHMENT ON THE STRUCTURE OF A SALT MARSH DIATOM COMMUNITY,
Delaware Univ., Newark. Dept. of Biological Sciences.
M. J. Sullivan.
Journal of Phycology, Vol 12, p 205-210, 1976. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Salt marshes, *Diatoms, *Light intensity, *Nutrients, Wetlands, Phosphorus, Nitrogen, Marshes, Distribution patterns, Marsh plants, Marsh management, Cutting management.

Clipping or shading the dwarf Spartina alterniflora cover over a diatom community, or phosphorus enrichment caused significant decreases in both species diversity and the number of diatom species, whereas nitrogen enrichment only significantly decreased the latter parameter. Of the 105 diatom taxa identified, only 10 were restricted to certain of the study areas; and of these, 8 occurred exclusively in the clipped habitats. Synthesis of these results with earlier work by the author showed that differences in diatom community structure beneath the three dominant marsh grasses were not primarily caused by differences in reduction of light intensity by their grass canopies, and that clipping of the S. alterniflora produced a shift in community structure towards that characteristic of a salt panne algal mat. (Steiner-Mass)
W80-05621

NITROGEN TRANSFORMATIONS AND UTILIZATION BY SPARTINA ALTERNIFLORA IN A LOUISIANA SALT MARSH,
Louisiana State Univ., Baton Rouge.
R. J. Buresh.
Ph.D. Dissertation, 1978. 131 p.

Descriptors: *Salt marshes, *Marsh plants, *Nitrogen, Wetlands, *Louisiana, Biomass, Grasses, Nutrient requirements, Fertilizers, Marsh management, Soils, Plant growth, Distribution patterns.

Nitrogen utilization by Spartina alterniflora and inorganic nitrogen transformations in marsh soil were investigated in field, greenhouse, and laboratory experiments. The variation in plant nitrogen content, soil nitrogen, and selected soil properties with distance inland from a natural stream toward an interdistributary basin in the marsh are also measured. Added nitrogen (200 kg/ha) significantly increased total aboveground plant biomass and plant height by 28 and 25%, respectively, 4 months after application. The total belowground to total aboveground biomass was decreased from 5.7 to 4.7 by the amended nitrogen. The total nitrogen content of S. alterniflora in June and September tended to be greater at streamside than inland sites. Total soil nitrogen increased with distance inland and ranged between 0.43 and 0.86% on a dry weight basis. (Steiner-Mass)
W80-05622

DISTURBANCE TOLERANCE AND COMPETITION IN BRACKISH MARSH PLANTS,
Princeton Univ., NJ.
B. F. Leon.
Ph.D. Dissertation, May, 1979. 109 p.

Descriptors: *Brackish water, *Marsh plants, *Competition, Wetlands, Marshes, Maryland, Distribution patterns, Muskrats, Plant growth, Root systems, Grasses.

Variations in the mixture of plant species in a brackish marsh on Maryland's eastern shore are due in large part to the differential effects of disturbances on the species and to competition between species. Fire and muskrat trenches occur unevenly on the marsh and their effects on the plants may be observed separately and together. Tolerant species are excluded from undisturbed areas of the marsh by interference competition from the intolerant species. Shading is indicated by shoot height in the marsh grasses, Spartina patens and Distichlis spicata, and each reacts to shading by the other in proportion to their relative densities. Underground crowding of roots and rhizomes seems to cause some species to be excluded from undisturbed areas; they are displaced to lower levels in the soil from which their shoots cannot penetrate to the surface. (Steiner-Mass)
W80-05623

ACTINOMYCETES OF A SALT MARSH,
Rutgers - The State Univ., New Brunswick, NJ.
J. C. Hunter.
Ph.D. Dissertation, 1978. 288 p.

Descriptors: *Salt marshes, *New Jersey, *Actinomycetes, Wetlands, Marshes, Marine microorganisms, Microorganisms, Aquatic microorganisms, Soil microorganisms, Marsh plants, Distribution patterns.

Marsh actinomycete isolates included members of the genus Streptomyces, Micromonospora, and Nocardia. Many streptomycete types but only six Micromonospora types were isolated from marsh samples. Some streptomycete types appear to be associated with specific plants. Micromonospora were frequently isolated from creek/channel muds especially during the summer months. Minor differences in utilization of substrates per se were noted between marsh and terrestrial forest actinomycete populations. However, marsh plant and soil isolates exhibited seasonal fluctuations in substrate utilization patterns whereas forest terrestrial plant and soil isolates showed more consistent utilization of substrates. This difference in seasonal populations implies that there are distinct salt marsh and terrestrial forms. Marsh Micromonospora were the most efficient population in the utilization of polysac-charides when compared to marsh and terrestrial forest streptomycetes. Marsh streptomycetes exhibited an ability to sporulate at higher salinities than their terrestrial forest counterparts. An ability to adjust to seasonal fluctuations in salinity was also exhibited by marsh streptomycetes; spring and summer isolates sporulated at higher salinities than fall or winter streptomycetes. These differences were not observed for forest or terrestrial seasonal isolates. Marsh Micromonospora did not sporulate above 1% salinity of sea salts or below a pH of 5.5. (Steiner-Mass)
W80-05625

ENERGY FLOW IN A HARPACTICOID COMMUNITY OF A SALT MARSH POOL,
Northeastern Univ., Boston, MA.
G. Gillis.
Ph.D. Dissertation, 1977. 209 p.

Descriptors: *Productivity, *Copepods, *Salt marshes, Massachusetts, Wetlands, Energy, Marshes, Detritus, Aquatic animals, Crustaceans.

The relative importance of harpacticoid copepods in the consumption of vegetation in a salt marsh pool was investigated in the Parker River National Wildlife Refuge, Massachusetts. It was postulated that since harpacticoids are present in high numbers, they may be significant intermediates of energy flow in the pool. They were found to average 323,000 individuals/sq m with a biomass of 388 mg dry weight. They ingested energy at a rate of 200 Kcal/sq m/yr of which 15 Kcal were transmitted to other trophic levels as harpacticoid biomass, 26 Kcal were respired, and 160 Kcal were egested to become part of the detritus. Total energy accumulated in the pool amounted to 2960 Kcal/sq m/yr of which 980 were produced by photosynthesis and 1970 were imported. Of this total, 2060 were used in pool community respiration and 900 were stored or exported. According to other assumptions, of the total energy accumulated in the pool, the harpacticoids ingest 6.7%, respire 0.9%, convert 0.5% to harpacticoid biomass making it available to other trophic levels, and egest 5.3% to become part of the detritus. (Steiner-Mass)
W80-05626

BIOLOGICAL DINITROGEN FIXATION (ACETYLENE REDUCTION) ASSOCIATED WITH FLORIDA MANGROVES,
University of South Florida, Tampa. Dept. of Biology.
For primary bibliographic entry see Field 2K.
W80-05627

UNDERGROUND BIOMASS PROFILES AND PRODUCTIVITY IN ATLANTIC COASTAL MARSHES,
Georgia Univ., Sapelo Island. Marine Inst.
J. L. Gallagher, and F. G. Plumley.
American Journal of Botany, Vol 66, No 2, p 156-161, 1979. 5 Fig, 5 Tab, 11 Ref.

Descriptors: *Coastal marshes, *Root distribution, *Marsh plants, Wetlands, Biomass, Salt marshes, Root systems, Marshes, Delaware, Maine, Georgia, Rates.

Three types of underground biomass profiles were found. In the first, the concentration of macroorganic matter (MOM) was uniform in depth; an example of this type was creekbank Spartina alterniflora in the southern part of the coast. A second type has a high MOM concentration at the surface which decreased with depth; exemplified by Spartina patens, S. alterniflora from the high marsh along the southern coast, and creekbank S. alterniflora from the northern part of its range. The third profile type was seen where a large rhizome mat developed 15-20 cm below the surface. Spartina cynosuroides and Phragmites communis are examples. Minimum annual production values ranged from 80 g C/sq m for northern creekbank S. Alterniflora to 1690 g C/sq m for Juncus gerardi in Maine. The mean for all plant stands was 650 g C/sq m. Within the MOM pool there are several components with turnover times varying from days to years. The turnover time for the entire pool ranged from 18 months in two Georgia salt marshes to 224 months for one in Maine. In the two instances where values for a species could be compared between Maine and Georgia, the turnover time was shorter at the more southerly site. (Steiner-Mass)
W80-05629

THE DISTRIBUTIONS, TROPHIC ACTIVITIES, AND COMPETITIVE INTERACTIONS OF THREE SALT MARSH KILLIFISHES (PISCES: CYPRINODONTIDAE),
Lehigh Univ., Bethlehem, PA.
J. P. Clymer.
Ph.D. Dissertation, 1978. 295 p.

Descriptors: *Distribution patterns, *Killifishes, *Fish populations, *New Jersey, *Salt marshes, Trophic level, Wetlands, Competition, Marshes, Secondary productivity, Aquatic habitats, Fish, Food chains.

During a sixteen-month period, the distributions, trophic activities, and competitive interactions of Fundulus heteroclitus, Fundulus majalis, and Cyprinodon variegatus were investigated in a temperate salt marsh embayment of Hereford Inlet, New Jersey. F. heteroclitus and C. variegatus commonly coexisted and dominated at upper estuary stations, while F. majalis dominated the lower estuary. There was a relatively greater abundance of F. heteroclitus in the spring and early summer seasons, while F. majalis and C. variegatus reached maximum abundances during the late summer and

fall. These killifish are active consumers of intertidal animals, and exert an important influence on the distribution of that community. This relationship is further intensified by the behavior of killifishes to remain in specific areas. Gut analyses indicated that killifish extract energy at the primary, secondary, and tertiary levels of the salt marsh food chain and in turn, are consumed by many estuarine predators. They rank among the most important trophic links in the intertidal salt marsh habitat. (Steiner-Mass)
W80-05630

THE ROLE OF MACROBENTHIC ORGANISMS IN MERCURY, CADMIUM, COPPER AND ZINC TRANSFERS IN GEORGIA SALT MARSH ECOSYSTEMS,
Emory Univ., Atlanta, GA.
For primary bibliographic entry see Field 5B.
W80-05631

THE PHYSIOLOGY OF SOME BLUE-GREEN ALGAL ISOLATES FROM PEAT,
University Coll., Galway (Ireland). Dept. of Microbiology.
F. Dooley, and J. A. Houghton.
Brittish Phycological Journal, Vol 8, p 295-300, September, 1973. 2 Fig, 1 Tab, 17 Ref.

Descriptors: *Cyanophyta, Peat, *Environmental effects, Wetlands, Bogs, Ireland, Hydrogen ion concentration, Phosphorus, Soil algae, Nutrient requirements.

An investigation of the physiology of a number of blue-green algae isolated from peat sites in Glenamoy, Co. Mayo is reported. Physical and nutritional parameters were studied and correlated to the conditions prevailing in the natural environment of the algae. The occurrence of blue-green algae in peat was found to be controlled by the pH level and the presence of phosphorus in the environment. (Steiner-Mass)
W80-05634

ABOVE-GROUND PRODUCTION OF MARSH CORDGRASS (SPARTINA ALTERNIFLORA) NEAR THE NORTHERN END OF ITS RANGE,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
B. G. Hatcher, and K. H. Mann.
Journal of the Fisheries Research Board of Canada, Vol 32, No 1, p 83-87, 1975. 3 Fig, 2 Tab, 20 Ref.

Descriptors: *Standing crop, *Marsh plants, Wetlands, Productivity, Grasses, Marshes, Salt marshes.

In Petpeswick Inlet, Nova Scotia, the above-ground portion of Spartina alterniflora lost an estimated 152 g dry weight per sq m of dead leaves during the growing season and reached an average biomass of 558 g dry weight per sq m at the end of the growing season. The total production of 710 g dry weight is higher than that recorded at many sites between Nova Scotia and North Carolina, in spite of the fact that in Nova Scotia the species is near the northern end of its range. (Steiner-Mass)
W80-05637

A SITE INDEX FORMULA FOR PEATLAND BLACK SPRUCE IN ONTARIO,
Great Lakes Forest Research Center, Sault Stainte Marie (Ontario).
B. Payandeh.
The Forestry Chronicle, Vol 54, No 1, p 39-41, February, 1978. 1 Fig, 2 Tab, 16 Ref.

Descriptors: *Bogs, *Coniferous trees, Wetlands, Peat, Trees, Forest management, Plant growth, Stem analysis, Ontario, Site index formula.

Site index formulas were derived for peatland black spruce (Picea mariana (Mill.) B.S.P.) in northern Ontario based on stem analysis of 60 dominant and codominant trees. Nonlinear regression analysis and a biological growth function were employed to express both height as a function of site index and stand age and also site index as a function of stand height and age. Analysis of results indicates that peatland black spruce has a different pattern of height growth than that shown by Plonski's site index curves, particularly for site indices less than 8 m and stands older than 80 years. (Steiner-Mass)
W80-05639

METAL CONTENT OF SPHAGNUM MOSSES FROM TWO NORTHERN CANADIAN BOG ECOSYSTEMS,
Canada Centre for Inland Waters, Burlington (Ontario).
W. A. Glooschenko, and J. A. Capobianco.
Water, Air, and Soil Pollution, Vol 10, p 215-220, 1978. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Bogs, *Mosses, *Metals, Wetlands, Marsh plants, Calcium, Plant physiology, Iron, Geochemistry, Trace elements, Heavy metals, Chemical analysis, Lakes, Canada.

Samples of Sphagnum moss were collected from Kinoje Lake, northern Ontario, and Porter Lake, Northwest Territories (N.W.T.), Canada. The samples were analyzed for the elements Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg and Zn. On a dry-weight basis, Ca was highest in concentration followed by Mg, Fe and Mn. The other elements were an order of magnitude or more lower in concentration. In general, concentrations were similar to those reported in the literature from Scandinavia. The two Canadian sites were similar in elemental composition except that the Ontario site was higher in Cd and Pb, while the N.W.T. site was higher in Mg and Hg. These differences could be due to a combination of regional geochemical and human activity differences. (Steiner-Mass)
W80-05640

INHIBITION OF METHANOGENESIS IN SALT MARSH SEDIMENTS AND WHOLE-CELL SUSPENSIONS OF METHANOGENIC BACTERIA BY NITROGEN OXIDES,
Georgia Univ., Athens. Dept. of Microbiology.
W. L. Balderston, and W. J. Payne.
Applied and Environmental Microbiology, Vol 32, No 2, p 264-269, August, 1976. 5 Fig, 1 Tab, 16 Ref.

Descriptors: *Salt marshes, *Methane bacteria, *Inhibition, Wetlands, Marsh management, Marshes, Nitrogen compounds, Muck soils, Sediments, Soil bacteria, Methane.

Hydrogen-dependent evolution of methane from salt marsh sediments and whole-cell suspensions of Methanobacterium thermoautotrophicum and Methanobacterium formicicum ceased or decreased after the introduction of nitrate, nitrite, nitric oxide, or nitrous oxide. Sulfite had a similar effect on methanogenesis in the whole-cell suspensions. In salt marsh sediments, nitrous oxide was the strongest inhibitor, followed by nitric oxide, nitrite, and nitrate in decreasing order of inhibition. In whole-cell suspensions, nitric oxide was the strongest inhibitor, followed by nitrous oxide, nitrite, and nitrate. Consideration of the results from experiments using an indicator of oxidation potential, along with the reversed order of effectiveness of the nitrogen oxides in relation to their degree of reduction, suggests that the inhibitory effect observed was not due to a redox change. Evidence is also presented that suggests that the decrease in the rate of methane production in the presence of oxides of nitrogen was not attributable to competition for methane-producing substrates. (Steiner-Mass)
W80-05643

SMALL RODENTS, THEIR HABITATS, AND THE EFFECTS OF FLOODING AT WICKEN FEN, CAMBRIDGESHIRE,
Cambridge Univ. (England). Dept. of Applied Biology.
J. R. Flowerdew, S. J. G. Hall, and J. C. Brown.
Journal of Zoology, London, Vol 182, p 323-342, 1977. 4 Fig, 11 Tab, 30 Ref, 1 Append.

Descriptors: *Fens, *Rodents, *Distribution patterns, *Flooding, Wetlands, Wildlife, Marshes, Mammals, Marsh plants, Wildlife habitat.

Clethrionomys glareolus is the commonest rodent species occurring at relatively high densities and closely associated with sedge growth. Micromys minutus are caught only in sedge and litter. Apodemus sylvaticus seem to show no marked habitat preference but there are some data which suggest that high Clethrionomys densities can affect Apodemus distributions locally. Microtus agrestis prefers grassy patches within sedge fields; trap success points tending to be associated with the presence of Calamagrostis canescens. Microtus avoids fen carr and unmanaged sedge and is generally caught more often in litter fields than in sedge fields; however, this preference seems to disappear at the end of the Clethrionomys breeding season. (Steiner-Mass)
W80-05644

NEST-SITE SELECTION OF WILLETS IN A NEW JERSEY SALT MARSH,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Biology.
J. Burger, and J. Shisler.
Wilson Bulletin, Vol 90, No 4, p 599-607, December, 1978. 3 Fig, 19 Ref.

Descriptors: *Distribution patterns, *Nests, *Wading birds, *Salt marshes, Wetlands, Marsh plants, Habitat, New Jersey, Wildlife habitat.

The nest sites chosen by Willets did not differ from random points with respect to several vegetation characteristics including species of vegetation, percentage live cover, percentage dead cover, mean height of the live and dead grass, and distance to ecotone. Willets selected nest sites on high ground, often spoil piles. The Willets nesting in the study marshes nested closer together than expected by chance. Upon examining these dense nesting areas, however, they nested farther apart than expected by chance. Thus, Willets spaced themselves in clumps. The advantage of nesting on spoil piles are discussed as well as the advantages and disadvantages of the nesting pattern with respect to social factors. (Steiner-Mass)
W80-05645

GROWTH MEASUREMENTS OF FIVE SPHAGNUM SPECIES IN SOUTH NORWAY,
Oslo Univ. (Norway). Botanical Lab.
A. Pedersen.
Norwegian Journal of Botany, Vol 22, p 277-284, 1975. 2 Fig, 2 Tab, 12 Ref.

Descriptors: *Plant growth, *Mosses, *Bogs, Ecological distribution, *Growth rates, Marsh plants, Wetlands, Norway.

Growth in length (cm) and production of dry matter (g dm(-2)) were determined by the cylinder method for five Sphagnum species from seven mire localities near Lauvtjern in Aust-Agder, South Norway. Sphagnum cuspidatum, S. fallax, and S. pulchrum, which prefer wet habitats, had greater increase of growth in length than had S. magellanicum and S. papillosum, which are confined to drier habitats. Sphagnum falla fallax was the most productive species with an annual production of dry matter of 5.0 g dm (-2). Growth measurements of S. pulchrum have not been carried out earlier. In particular, the correlation between the growth of Sphagna and ecological factors (climate, subsoil water table) was studied. It is suggested that drying damages in the heads of Sphagnum were caused by too high peat temperature, by lack of water, or both in combination, resulting in limited growth during June-September. (Steiner-Mass)
W80-05646

TOLERANCE OF TREE ROOTS TO WATERLOGGING, I. SURVIVAL OF SITKA SPRUCE AND LODGEPOLE PINE,
Northern Research Station, Edinburgh (Scotland). Forestry Commission.
M. P. Coutts, and J. J. Philipson.
New Phytologist, Vol 80, p 63-69, 1978. 1 Fig, 3

Tab, 15 Ref.

Descriptors: *Plant growth, *Saturated soils, *Coniferous trees, Bogs, Peat, Soil water, Trees, Lodgepole pine trees, Resistance.

Rooted cuttings of Sitka spruce and Lodgepole pine were grown in Perspex tubes of peat and the lower portion of the root systems was flooded, while either active or dormant, and at 6 and 15C. Root survival was assessed after draining the tubes. Root elongation in both species stopped within a few days of flooding, during which the oxygen flux in the peat had declined to zero. Actively growing root tips were more susceptible to waterlogging than the region behind the tip and the latter region remained alive for up to 90 cm below the water-table in certain treatment. Growing roots of pine were more tolerant to waterlogging than spruce, when assessed in terms of the survival of both the tip and the basal region of the root. By contrast, dormant roots of both species were so tolerant to waterlogging that the tips remained alive and rapid regrowth took place after the soil was drained. (Steiner-Mass)
W80-05647

COMPARISONS OF SALT-MARSH FUCOID PRODUCTION ESTIMATED FROM THREE DIFFERENT INDICES,
State Univ. of New York at Stony Brook. Div. of Biological Sciences.
B. H. Brinkhuis.
Journal of Phycology, Vol 13, p 328-335, 1977. 6 Fig, 1 Tab, 20 Ref.

Descriptors: *Salt marshes, *Marine algae, *Computer models, *Primary productivity, Wetlands, Standing crop, Marshes, Model studies, Marsh plants, Biomass, Photosynthesis, Aquatic microorganisms.

Production of Ascophyllum nodosum (L.) LeJolis ecads and Fuscus vesiculosus L., was calculated from measurements of in situ growth, seasonal variations in standing crops and seasonal variations in photosynthetic capacity. A computer model for predicting daily, monthly and yearly net production from photosynthesis data was constructed. This model used daily irradiation, actual biomass of algae/sq m contributing to production and photosynthesis vs. light intensity relationships as data inputs. Comparison of production estimated from in situ growth, standing-crops and photosynthesis indicated that both marsh fucoids turn over biomass twice per year. Total net production of both fucoids, estimated from photosynthesis data, was ca, 315 g C/sq m/yr. On the other hand, production of both fucoids calculated from standing-crop data was only 155 g C/sq m/yr. (Steiner-Mass)
W80-05648

COMPARISONS OF FOUR METHODS FOR DETERMINATION OF DEGREE OF PEAT HUMIFICATION (DECOMPOSITION) WITH EMPHASIS ON THE VON POST METHOD,
Great Lakes Forest Research Centre, Sault Sainte Marie (Ontario).
W. Stanek, and T. Silc.
Canadian Journal of Soil Science, Vol 57, p 109-117, 1977. 6 Tab, 10 Ref, 1 Append.

Descriptors: *Analytical techniques, *Determination, *Peat, Wetlands, *Decomposing organic matter, Laboratory tests, Evaluation.

The degree of decomposition (humification) of 10 peats, ranging from undecomposed to completely decomposed, was determined by the following methods: (1) von Post's method using 10 classes of humification, (2) pyrophosphate-soluble organic matter determination using an index derived from Munsell color charts, (3) unrubbed fiber content in percent of total, (4) rubbed fiber content in percent of total. All four methods provided reliable and useful information. The von Post method requires no instrumentation and is therefore most suitable for field use. It is the least time-consuming and the cheapest of the four methods. The pyrophosphate method is best suited to use in a laboratory. It does not always readily differentiate grades of well humified and completely humified peats. Both methods of determining fiber content require more accurately characterizes the amounts of undercomposed fiber in peat. In the range of humic peats the two latter methods tend to differentiate fewer classes than does the von Post method. For the convenience of the reader, the four methods are described in detail in the Appendix. (Steiner-Mass)
W80-05649

AUTOTROPHIC AND HETEROTROPHIC NUTRITIONAL BUDGET OF SALT MARSH EPIPHYTIC ALGAE,
City Coll., New York. Dept. of Biology.
M. N. Saks, R. J. Stone, and J. J. Lee.
Journal of Phycology, Vol 12, p 443-448, 1976. 5 Tab, 36 Ref.

Descriptors: *Algae, *Salt marshes, *Primary productivity, Wetlands, Carbon cycle, Marshes, Amino acids, Marsh plants, Epiphytology, *Nutrient requirements, Plant growth, Marine algae, Aquatic microorganisms.

This paper addresses the nutrition and relative importance of primary production to heterotrophy of select unicellular green algae and diatoms from the same assemblage. Algal growth responses to nutrient additions varied widely. Such responses included: inhibition and enhancement of growth by amino acid additions; nonstimulation or inhibition by most sugars at 10 mM concentration; glucose stimulation of 6 and inhibition of 3 species; fructose inhibition of 6- and 3-fold stimulation of one species; stimulation of most species by a vitamin mixture, some natural products, metabolite mixtures, etc. Photoassimilation of glucose and acetate in 8 or 12 species occurred. Nine of 12 species took up only a fraction of the total carbon fixed as organic substrate. Enhancement of photosynthesis by glucose and inhibition by acetate was common. The data suggest that attached littoral and shoal marine algal assemblages may play mixed trophic roles at lower levels of the detrital food web. (Steiner-Mass)
W80-05650

MICROBIOLOGICAL AND PHYSICAL PROPERTIES OF SALT MARSH AND MICROECOSYSTEM SEDIMENTS,
South Carolina Univ., Columbia.
For primary bibliographic entry see Field 2G.
W80-05651

EDGE EFFECTS ON SALT MARSH ARTHROPOD COMMUNITY STRUCTURES,
Georgia Univ., Athens.
D. P. Webb.
Journal of the Georgia Entomological Society, Vol 11, No 1, p 17-27, January, 1976. 5 Fig, 2 Tab, 25 Ref.

Descriptors: *Salt marshes, *Aquatic habitats, *Biological communities, Wetlands, Migration, Marshes, Biomass, Marsh plants, Grasses, Trophic levels, Insects, Spiders.

Arthropod and plant community parameters were estimated in above ground vegetation in adjacent salt marsh sites of varying plant diversity. Support for the existence of a discrete low and a less discrete high marsh plant-arthropod community is established. The herbivore to plant biomass ratio and herbivorous species similarity in the Spartina dominated low marsh exceeded that of the Sporobolus dominated high marsh. Spartina therefore appears to be a higher quality herbivore food than the high marsh plants. The carnivore to 'other arthropod' biomass ratio and carnivorous species similarity was largest in the high marsh, although other trophic levels proved not to be discrete subcommunities. Although Spartina seemed to control arthropod biomass distribution, increased arthropod diversity occurred in the succulent dominated, Spartina-less edge of the high marsh as well as in the edge of the low marsh community. Increased density of arthropods as an edge effect did not occur; only the diversity component is present. (Steiner-Mass)
W80-05652

LARGE-SCALE DEMONSTRATION OF AQUATIC PLANT MAPPING BY REMOTE SENSING,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 7C.
W80-05655

BLADE WIDTH OF LAMINARIA LONGIPES (PHAEOPHYCEAE, LAMINARIALES) AS AN INDICATOR OF WAVE EXPOSURE,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
J. F. Palmisano, and Y. S. Sheng.
Syesis, Vol 10, p 53-56, 1977. 1 Fig, 1 Tab, 19 Ref.

Descriptors: *Aquatic plants, *Intertidal areas, *Waves(Water), Alaska, Algae, Ocean waves, Leaves.

Data analysis of Laminaria longipes, a lower intertidal and upper subtidal level coastal plant, from four western Aleutian islands reveals that plant blades in exposed areas are significantly narrower than blades from sheltered areas. Blade width of L. longipes is suggested as an indicator of relative exposure to wave action. (Steiner-Mass)
W80-05656

DETECTION AND MONITORING OF WATER HYACINTH (EICHHORNIA CRASSIPES) INFESTATION IN LAGUNA DE BAY THROUGH MULTISPECTRAL DIGITAL ANALYSIS OF LANDSAT IMAGERIES,
Natural Resource Management Center, Quezon City (Philippines).
For primary bibliographic entry see Field 7B.
W80-05659

BIOLOGY OF INTERTIDAL SALDULA PALUSTRIS (DOUGLAS) ON THE OREGON COAST (HETEROPTERA: SALDIDAE),
Washington State Univ., Pullman. Dept. of Entomology.
M. W. Stock, and J. D. Lattin.
Kansas Entomological Society, Vol 49, No 3, p 313-326, July, 1976. 3 Fig, 1 Tab, 28 Ref.

Descriptors: *Aquatic insects, *Oregon, *Salt marshes, Wetlands, Temporal distribution, Marshes, Distribution patterns, Tidal effects, Tidal marshes.

Saldula palustris inhabits estuarine salt marshes along the Oregon coast. There are three generations per year. Adults migrate from the intertidal zone and overwinter. Reproductive diapause during the winter is facultative. Adult insects return to the intertidal site in January and nymphs are present from April until October. The insects are aggressive predators and cannibalism is common. They tolerate daily tidal submergence periods of up to 9 hrs. duration. They do not retreat before the incoming tide and remain quiescent when submerged. S. palustris is considered a transitional form with behavioral but as yet limited structural adaptations to aquatic life. (Steiner-Mass)
W80-05663

PHOTOSYNTHETICALLY ACTIVE RADIATION IN A STAND OF PHRAGMITES COMMUNIS TRIN. I. DISTRIBUTION OF IRRADIANCE AND FOLIAGE STRUCTURE,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
For primary bibliographic entry see Field 2H.
W80-05667

WIND-BLOWN DUST AS A SOURCE OF NUTRIENTS FOR AQUATIC PLANTS,
California Univ., Santa Barbara. Dept. of Biological Sciences.
C. L. McLay.
Environmental Pollution, Vol 5, p 173-180, 1973. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Pondweeds, *Dust, *Nutrients, Aquatic plants, Floating plants, Marsh plants, Air pollution, Salts, Environmental effects.

The importance of natural and man-made dust accumulated on plant leaves, to the plant itself and to the surrounding vegetation, has received little attention, although several workers have shown that this may be a form of pollution causing damage to plant growth. This paper reports the results of an experiment to measure the response of Lemna perpusilla to dust washed from the stems of Scirpus californicus which grows with the duckweed. Duckweed growth was stimulated by the washings and it was also found that growth could be stimulated by dust that had accumulated on a concrete wall near the lake. It is evident that dust from both sources can produce an immediate growth response by duckweed and so must contain soluble nutrients. There is some evidence that salts leached from the Scirpus stems may have been partially responsible for the increase in growth, and the utilization of nutrients from this source by aquatic plants represents a previously unsuspected pathway in the nutrient cycle of a lake. (Steiner-Mass)
W80-05668

EFFECTS OF TUBIFICIDS (BRANCHIURA SOWERBYI AND LIMNODRILUS SOCIALIS) ON THE NATURE OF A SUBMERGED SOIL ECOSYSTEM,
Tohoku Univ., Sendai (Japan). Biological Inst.
E. Kikuchi, C. Furusaka, and Y. Kurihara.
Japanese Journal of Ecology, Vol 27, p 163-170, 1977. 15 Fig, 3 Tab, 6 Ref.

Descriptors: *Tubificids, *Aquatic soils, *Wetlands, Annelids, Benthic fauna, Vegetative effects, Hydrogen ion concentrations, Oxygen, Japan.

Measurements of the chemical and biological nature of submerged paddy soil in vitro with an without tubificids revealed that the presence of tubificids inhibited the growth of weeds and increased the frequency of appearance of Moina sp., and that the presence of weeds led to an increase in the Eh of soil, a decrease in the pH and a decrease in the activity of the soil's biological and nonbiological uptake of 02. Examination of the changes of biotic and abiotic factors by artificial mixing of the soil led to the supposition that the action of tubificids is similar to physical mixing of the soil. (Steiner-Mass)
W80-05673

COMPARATIVE GAS EXCHANGE CHARACTERISTICS OF THREE MANGROVE SPECIES DURING THE WINTER,
California State Univ., San Diego. Dept. of Biology.
For primary bibliographic entry see Field 2L.
W80-05677

THE TRANSLOCATION OF LEAD AND COPPER IN TWO SUBMERGED AQUATIC ANGIOSPERM SPECIES,
Westfield Coll., London (England).
For primary bibliographic entry see Field 5B.
W80-05678

2J. Erosion and Sedimentation

FATES OF METAL RADIOTRACERS ADDED TO A WHOLE LAKE: SEDIMENT-WATER INTERACTIONS,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2H.
W80-05416

PERMEABILITY AND PIPING IN FRACTURED ROCKS,
California Univ., Berkeley. Dept. of Geological Engineering.
For primary bibliographic entry see Field 8B.
W80-05431

LONGSHORE SEDIMENT TRANSPORT BY TIDAL CURRENTS,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2L.
W80-05479

WHOLE-LAKE MODEL FOR THE DISTRIBUTION OF SEDIMENT-DERIVED CHEMICAL SPECIES,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2H.
W80-05488

THE DIFFUSION COEFFICIENTS OF SULFATE, AMMONIUM, AND PHOSPHATE IONS IN ANOXIC MARINE SEDIMENTS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
M. D. Krom, and R. A. Berner.
Limnology and Oceanography, Vol 25, No 2, p 327-337, March 1980. 4 Fig, 2 Tab, 34 Ref. NSF OCE77-03473, OCE79-06919.

Descriptors: *Diffusion, *Sediments, *Ions, *Laboratory tests, Sampling, Cores, Sulfates, Ammonia, Phosphates, Data processing, Theoretical analysis, Diffusivity, Sedimentology, *Long Island Sound, Marine sediments.

The diffusion coefficients of sulfate, ammonium, and phosphate ions were determined directly in the laboratory by placing two samples of homogenized, anoxic mud from Long Island Sound in contact with one another across a planar interface. After 141 h concentration profiles were determined, and from them values of effective diffusion coefficients (which incorporate the effects of adsorption) were calculated. Correction of these values for adsorption, using independently determined linear adsorption constants for the same sediments, gave the following values (X0.000001 sq cm/s, 20C, errors + or - 2 sigma): D sub s (SO4), 5.0 + or - 1.2; D sub s (NH4), 9.8 + or - 2.0; D sub s (PO4), 3.6 + or - 1.1. These values agree well with values calculated for the same sediments from estimates of formation factors plus data for diffusion coefficients at infinite dilution. (Sims-ISWS)
W80-05490

RECENT SEDIMENTATION AND ITS RELATIONSHIP WITH PRIMARY PRODUCTIVITY IN FOUR WESTERN WASHINGTON LAKES,
Washington Univ., Seattle. Dept. of Civil Engineering.
P. B. Birch, R. S. Barnes, and D. E. Spyridakis.
Limnology and Oceanography, Vol 25, No 2, p 240-247, March 1980. 5 Fig, 4 Tab, 26 Ref. NSF DEB74-20744.

Descriptors: *Sedimentation, *Lakes, *Forest watersheds, *Primary productivity, *Washington, On-site investigations, On-site data collections, Sediments, Cores, Sedimentation rates, Chemicals, Carbon, Nitrogen, Phosphorus, Nutrients, Lumbering, Lead, Lead radioisotopes, Radioactive dating, Runoff, Watersheds(Basins), Land use.

Studies of sedimentation processes in four western Washington lakes reveal up to sixfold variations in sedimentation rates over the past 130 years of settlement in the region. These variations in sedimentation can be linked with known changes in land use in the watersheds, especially logging, which appears to have accelerated erosion. Contemporary deposition of phosphorus into profundal sediments is positively correlated with phytoplankton productivity in the four lakes. If a similar relationship existed in the past when sedimentation rates of phosphorus were different, then increases in primary productivity from twofold to fourfold could have occurred in three of the lakes since about 1840. (Sims-ISWS)
W80-05492

SHALLOW FAULTING, BOTTOM INSTABILITY, AND MOVEMENT OF SEDIMENT IN LOWER COOK INLET AND WESTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA.
M. A. Hampton, and A. H. Bouma.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 32-52, October 1979. 24 Ref, 6 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Sedimentation, *Faults(Geologic), *Pollutants, Nutrients, Drilling, Water pollution sources, Oil spills, Baseline studies, Alaska, Offshore platforms, *Outer Continental Shelf, Gulf of Alaska, Cook Inlet, Petroleum development.

The general nature of the study is the assessment of the environmental geologic hazards, sediment types and sediment distribution in lower Cook Inlet and on the Kodiak shelf, western Gulf of Alaska. Active faulting and sediment instability are potential dangers to offshore structures. The relation between morphology and sediment characteristics identify the presence of areas where erosion is more active than deposition and areas that are sediment traps and consequently act as sinks for pollutants as well as nutrients. Transport of sand over bedforms likely will increase once the sediments are stirred up by anchoring and trenching activities thereby removing fine clay and organic matter that presently decreases the natural erodibility. Field studies conducted during the summers of 1976, 1977 and 1978 show that no significant recent faulting can be detected within the lease area in lower Cook Inlet in spite of the high seismic activity of the area. On the Kodiak shelf the geo-environmental concerns are associated with the seismotectonic regime and the physical properties and dispersal of sediment. Included are the distribution of earthquake epicenters, tectonic segmentation, occurrence of shallow folds and faults, texture and composition of sediment, gas-charging of sediment, bedforms, slope stability, and sediment dispersal patterns. (Sinha-OEIS)
W80-05594

FAULTING, SEDIMENT INSTABILITY, EROSION, AND DEPOSITION HAZARDS OF THE NORTON BASIN SEA FLOOR,
Geological Survey, Menlo Park, CA.
H. Nelson, D. R. Thor, and M. C. Larsen.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 53-94, October 1979. 16 Fig, 45 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Seismic studies, *Faults(Geologic), Baseline studies, Construction, Water pollution sources, Tectonics, Environmental effects, Alaska, Resources development, *Erosion, *Sedimentation, *Outer Continental Shelf, Norton Basin, Environmental assessment, Petroleum development.

This research addresses geological hazards that may result from surface and near-surface faulting, sediment instability, and erosion and depostion processes in the Norton Basin region. Geological baseline parameters and process information also are generated that provide valuable ancillary information for other interdisciplinary studies. In this extremely shallow epicontinental shelf area the stability and maintenance of drilling rigs, production platforms, pipelines, and shoreline based facilities in the Norton Basin area are all threatened by potential hazards of active faulting, thermogenic gas charged sediments, thixotropic sediment, ice gouging, and sediment scour caused by current and wave erosion. Potential problems of biogenic gas venting and sediment collapse during storm wave interaction with the bottom must be understood prior to construction and installation of sea-floor structures for petroleum development. The 1978 cruise concentrated on topical studies which evolved from the reconnaissance work of earlier cruises. High-resolution geophysics, side-scan sonar, and new sediment vibracoring techniques were employed. (Sinha-OEIS)

W80-05595

GEOLOGIC IMPLICATIONS AND POTENTIAL HAZARDS OF SCOUR DEPRESSIONS ON BERING SHELF, ALASKA,
Geological Survey, Menlo Park, CA.
M. C. Larson, H. Nelson, and D. R. Thor.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 132-154, October 1979. 5 Fig, 42 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Scour, *Baseline studies, Construction, Resources development, Water pollution sources, Alaska, Environmental effects, *Sediments, *Outer Continental Shelf, *Bottom currents, Environmental assessment, Petroleum development, Norton Sound.

Broad (50-150 m) shallow (less than 1 m deep) depressions have been observed on sonographs from western Norton Sound. These features have much greater diameter, more irregular shape and flatter bottoms than the small, more conical craters observed in eastern Norton Sound, and may result from active sediment scour by strong near-bottom currents. Current scour of large depressions and association with intense ice gouging may be a hazard to the development of petroleum facilities in the Norton Sound area. Such potential geologic hazards are of concern because Norton Sound is favored for future resource development. Substrate reconnaissance employing high-resolution profiling, side-scan sonar reflection, bottom photography, underwater television, sediment-grain-size analysis, and examination of current dynamics has been undertaken to determine if large depressions represent ares of intense scour by currents. This paper describes depressions and their correlation with occurrence of strong currents, ice gouge furrows, major topographic shoals, and very fine sand to coarse silt substrate. (Sinha-OEIS)
W80-05598

THE ENVIRONMENTAL GEOLOGY AND GEOMORPHOLOGY OF THE BARRIER ISLAND - LAGOON SYSTEM ALONG THE BEAUFORT SEA COASTAL PLAIN,
Alaska Univ., Fairbanks.
For primary bibliographic entry see Field 5C.
W80-05600

DEPOSITIONAL CONTROL OF AQUIFER CHARACTERISTICS IN ALLUVIAL FANS, FRESNO COUNTY, CALIFORNIA: SUMMARY,
Science and Education Administration, Fresno, CA. Water Management Research.
D. Cehrs.
Geological Society of America Bulletin, Part I, Vol 90, No 8, p 709-711, August, 1979. 2 Fig, 6 Ref.

Descriptors: *Alluvial fans, *Deposition(Sediments), *Aquifer characteristics, Flood plains, Gradation, Particle size, Silts, Clays, Sands, Transmissivity, Storage coefficient, Specific capacity.

A depositional model is proposed to explain observed aquifer characteristics in an alluvial fan-flood plain system of vertical and lateral accretion deposits in eastern Fresno County. Downfan sedimentary segregation generally shows gradational grain-size decreases, improved sediment sorting, and decreased bedding thickness. Flood derived silt and clay have degraded some of the aquifer sand and gravel of the proximal fan. As a result, this area has the lowest transmissivities, storage coefficients, and well yields. The middle part of the fan is aggraded by channel migration from depositional ridges to interfluve lows, thereby increasing the area of distribution of sand-sized channel material. This produces highly stratified, thin, well-sorted beds of silt and fine sand with the greatest lateral and vertical continuity, and the highest aquifer characteristics. The distal parts of the fan have lower aquifer characteristics than the middle fan due to the fine-grained components (silt and clay) increasing downward. (Purdin-NWWA)
W80-05610

ANNUAL R VALUES IN NORTH MISSISSIPPI,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 2B.
W80-05636

SEDIMENTATION RATES ON TIDAL SALT MARSHES IN CONNECTICUT,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
E. Z. Harrison, and A. L. Bloom.
Journal of Sedimentary Petrology, Vol 47, No 4, p 1484-1490, December, 1977. 9 Fig.

Descriptors: *Sedimentation rates, *Tidal marshes, *Connecticut, Wetlands, Marshes, Salt marshes, Sedimentation, Tidal effects, Vegetation effects.

Rates of sediment accretion from 1963-1973 on five high marsh sites on the Connecticut coast of Long Island Sound ranged from 2.0 mm/yr to 6.6 mm/yr. The rates are correlated with tidal range; the highest sedimentation rates are on marshes with the greatest tidal range. The greater the tidal range, the larger are the deviations of high-tide level. Thus, greater net flooding occurs on high marshes with greater tide ranges and may cause the observed high accretion rates. Over ten years no measurable compaction has taken place within the near-surface sediment. Years with fewer than average storms show less sediment accretion. A sedimentation rate of 17.1 mm/yr from 1963-1973 was measured where Spartina patens salt marsh is giving way to Phragmites communis. (Steiner-Mass)
W80-05680

2K. Chemical Processes

SPRING CHARACTERISTICS OF THE WESTERN ROSWELL ARTESIAN BASIN,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 2F.
W80-05406

DYNAMICS OF CADMIUM-STRESSED PLANKTON COMMUNITIES,
Argonne National Lab., IL. Radiological and Environmental Research Div.
For primary bibliographic entry see Field 2H.
W80-05414

EXPERIMENTAL STUDY OF TRACE METAL CHEMISTRY IN SOFT-WATER LAKES AT DIFFERENT PH LEVELS,
Department of the Environment and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2H.
W80-05415

FATES OF METAL RADIOTRACERS ADDED TO A WHOLE LAKE: SEDIMENT-WATER INTERACTIONS,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2H.
W80-05416

EFFECTS OF ACIDIFICATION ON MOBILIZATION OF HEAVY METALS AND RADIONUCLIDES FROM THE SEDIMENTS OF A FRESHWATER LAKE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2H.
W80-05417

EFFECTS OF ARTIFICIAL ACIDIFICATION ON THE GROWTH OF PERIPHYTON,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2H.
W80-05418

EXPERIMENTAL ACIDIFICATION OF LAKE 223, EXPERIMENTAL LAKES AREA: BACKGROUND DATA AND THE FIRST THREE YEARS OF ACIDIFICATION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2H.
W80-05419

WATER QUALITY OF THE FRENCH BROAD RIVER, NORTH CAROLINA--AN ANALYSIS OF DATA COLLECTED AT MARSHALL, 1958-77,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-05445

GEOLOGIC MIGRATION POTENTIALS OF TECHNETIUM-99 AND NEPTUNIUM-237,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5E.
W80-05446

GEOCHEMICAL SURVEY OF WATERS OF MISSOURI,
Geological Survey, Lakewood, CO. Water Resources Div.
G. L. Feder.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Geological Survey Professional Paper 954-E, 1979. 78 p, 43 Fig, 8 Tab, 30 Ref, Append.

Descriptors: *Geochemistry, *Surface waters, *Groundwater, *Missouri, *Water quality, Water chemistry, Epidemiology, Public health, Analytical techniques, Chemical analysis, Sampling, Geohydrologic units, Correlation analysis, Variability, Trace elements, Environment, Water pollution.

A reconnaissance geochemical survey of surface and ground waters of the State of Missouri was made to provide epidemiologists with information on the state-wide distribution and variability of chemical constituents. Results from the state-wide sampling program, based on a hierarchical analysis of variance design and randomly chosen sampling sites, show that the concentrations of many chemical constituents in waters of Missouri vary both among and within the major geohydrologic units by statistically significant amounts. The chemical constituents in surface waters show fewer statistically significant differences between geohydrologic units than the ground waters, and in some geohydrologic units the surface water is chemically quite different from the ground water, especially in its trace element content. Where geohydrologic units overlie one another, there may be large differences in the quality of water obtained from closely spaced wells pumping water from different geohydrologic units. Analysis of the ground-water data by Q-mode factor analysis indicates that general chemical character of the waters can be moderately well described in terms of four theoretical water-types. These include (1) a Ca-Mg-HCO3 water with relatively high Cu, (2) a Na-HCO3-C1 water with high K, Li, Al, B, Rb, Sr, F, and Br, (3) a Ca-HCO3-SO4 water with high Fe and Mn, and (4) a water low in total dissolved solids and with low concentrations of trace elements. (Kosco-USGS)
W80-05454

MAP SHOWING POTENTIAL GEOTHERMAL-RESOURCE AREAS, AS INDICATED BY THE CHEMICAL CHARACTER OF GROUNDWATER IN VERDE VALLEY, YAVAPAI COUNTY, ARIZONA,
Geological Survey, Tucson, AZ. Water Resources Div.
For primary bibliographic entry see Field 1A.
W80-05456

ATMOSPHERIC LONG RANGE TRANSPORT OF LEAD TO DENMARK,
Copenhagen Univ. (Denmark). Inst. of Plant Ecology.
For primary bibliographic entry see Field 2B.
W80-05482

A STUDY OF THE CHEMICAL COMPONENTS OF AEROSOLS AND SNOW IN THE KASHMIR REGION,
Institute of Tropical Meteorology, Poona (India).
For primary bibliographic entry see Field 2B.
W80-05483

USING MODELS TO SIMULATE THE MOVEMENT OF CONTAMINANTS THROUGH GROUND WATER FLOW SYSTEMS,
Wisconsin Univ., Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W80-05547

BIOLOGICAL DINITROGEN FIXATION (ACETYLENE REDUCTION) ASSOCIATED WITH FLORIDA MANGROVES,
University of South Florida, Tampa. Dept. of Biology.
D. A. Zuberer, and W. S. Silver.
Applied and Environmental Microbiology, Vol 35, No 3, p 567-575, March, 1978. 5 Fig, 4 Tab, 20 Ref.

Descriptors: *Denitrification, *Aquatic bacteria, *Mangrove swamps, Rhizosphere, Wetlands, Root systems, Swamps, Sediments, Florida.

Low rates of acetylene reduction (0.01 to 1.84 nmol of C2H2/g (wet weight)/h) were associated with plant-free sediments, while plant-associated sediments gave rise to slightly higher rates. Activity in sediments increased greatly upon the addition of various carbon sources, indicating an energy limitation for nitrogenase activity. In situ demonstrations of denitrogen fixation in sediments also indicated low rates and exhibited a similar response to glucose amendment. Litter from the green macroalga, Ulva spp., mangrove leaves, and sea grass also gave rise to significant rates of acetylene reduction. Higher rates of nitrogenase activity (15 to 53 nmol of C2H2/g (wet weight)(h) were associated with washed excised roots of three Florida mangrove species as well as isolated root systems of intact plants (11 to 58 micrograms of N/g (dry weight)/h). Following a short lag period, root-associated activity was linear and did not exhibit a marked response to glucose amendment. It appears that denitrogen-fixing bacteria in the mangrove rhizoplane are able to use root exudates and/or sloughed cell debris as energy sources for denitrogen fixation. (Steiner-Mass)
W80-05627

GEOCHEMICAL AND MICROBIAL ASPECTS OF VOLO BOG, LAKE COUNTY, ILLINOIS,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 2H.
W80-05632

AUTHIGENIC MINERALS OF SULFUR IN MODERN PEAT BOGS OF THE URALS,
Institute of Geology and Geochemistry, Sverdlovsk (USSR).
E. I. Tarakanova.
Lithology and Mineral Resources, Vol 8, No 4, p 462-465, May, 1974. 2 Fig, 13 Ref.

Descriptors: *Bogs, *Sulphur, Wetlands, *Peat, *Russia, Mineralogy, Gypsum, Pyrite.

The study of Ural peats has established that there are two forms of sulfur manifestations: sulfate (gypsum) and sulfide (pyrite). Gypsum is located only in peat bogs of the Orenburg cis-Ural area, which are formed under conditions of insufficient moisture and increased temperature. The degree of gypsification depends on the ground water level and dampness of the peat bog. The formation of gypsum took place as a result of evaporation of sulfate-bearing ground waters. Pyrite is found in separate peat bogs on the eastern slope of the central Urals, which adjoin the Transural area and the Orenburg cis-Urals. Inclusions of pyrite are found in a limited area in the lower part of the deposit. It is formed due to the occurrence of sulfates which are dissolved in ground waters. Both minerals originate during the early diagenetic stage. (Steiner-Mass)
W80-05638

METAL CONTENT OF SPHAGNUM MOSSES FROM TWO NORTHERN CANADIAN BOG ECOSYSTEMS,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2I.
W80-05640

RELATION OF CHEMICAL DISCHARGE OF RIVERS TO THE SWAMPY CHARACTER OF DRAINAGE AREAS,
Akademiya Navuk BSSR, Minsk. Inst. Geokhimii i Geofiziki.
For primary bibliographic entry see Field 2H.
W80-05658

MIGRATORY PROPERTIES OF SOME NUCLEAR WASTE ELEMENTS IN GEOLOGIC MEDIA,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5E.
W80-05661

ARYLSULFATASE ACTIVITY IN SALT MARSH SOILS,
Georgia Univ., Athens. Dept. of Microbiology.
R. L. Oshrain, and W. J. Wiebe.
Applied and Environmental Microbiology, Vol 38, No 2, p 337-340, August, 1979. 2 Fig, 20 Ref.

Descriptors: *Salt marshes, *Enzymes, *Soil chemistry, Wetlands, Biochemistry, Marshes, Muck soils, Sulfate.

The presence of arylsulfatase(s) was confirmed in salt marsh soils. The temperatures of maximum activity and inactivation, the pH range over which the enzyme was active, and the Km values were similar to those of soil enzymes. Unlike soil arylsulfatases, however, the salt marsh enzymes do not appear to be repressed by sulfate. It is postulated that these enzymes may be necessary for the initiation of arylsulfate ester metabolism. (Steiner-Mass)
W80-05674

2L. Estuaries

NUMERICAL MODELING OF TIDAL CIRCULATION IN HARBORS,
Birmingham Univ. (England). Dept. of Civil Engineering.
R. A. Falconer.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 106, No WW1, Proceedings Paper 15187, p 31-48, February 1980. 7 Fig, 15 Ref, 2 Append.

Descriptors: *Coastal engineering, *Tides, *Estuaries, *Harbors, Currents(Water), Computer models, Circulation, Numerical analysis, Mathematical models, Waves(Water), Hydraulics, Flow, Forecasting, *Tidal currents.

In this study a numerical model was developed that can be used to predict the two-dimensional tide-induced velocity fields in harbors and estuaries. The model is particularly suited to basins having a narrow entrance where, on the incoming tide, the divergence of the velocity field associated with the jet inlet gives rise to the generation of vorticity. The time-dependent nonlinear equations of motion are formulated to include the effects of bottom roughness, wind action, the earth's rotation, and a simplified version of the turbulent transfer of momentum. These equations are expressed in an alternating-direction implicit finite difference form and are solved by Gaussian elimination. The numerical model has been checked by making comparisons between the computed velocity fields and experimentally measured velocities and path lines for two hydraulic model studies involving various rectangular harbors and a circular reservoir. (Lee-ISWS)
W80-05433

A TWO-DIMENSIONAL HYDRODYNAMIC MODEL OF A TIDAL ESTUARY,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. A. Walters, and R. T. Cheng.
In: Finite Elements in Water Resources; Proceedings of the Second International Conference on Finite Elements in Water Resources, held at Imperial College, London, in July, 1978, p 2.3-2.21. (1978) 7 Fig, 28 Ref. Pentech Press, Plymouth, London.

Descriptors: *Hydrodynamics, *Computer models, *Tides, *Estuaries, *Finite element analysis, Numerical analysis, Mathematical models, Equations, Currents(Water), Velocity, Evaluation, *San Francisco Bay(Calif), *Two-dimensional models, *Newton-Raphson method.

This paper describes a finite element model which is used in the computation of tidal currents in an estuary. This numerical model is patterned after an existing algorithm and has been carefully tested in rectangular and curve-sided channels with constant and variable depth. One of the common uncertainties in this class of two-dimensional hydrodynamic models is the treatment of the lateral boundary conditions. Special attention is paid specifically to addressing this problem. To maintain continuity within the domain of interest, 'smooth' curved-sided elements must be used at all shoreline boundaries. The present model uses triangular, isoparametric elements with quadratic basis functions for the two velocity components and a linear basis function for water surface elevation. An implicit time integration is used and the model is unconditionally stable. The resultant governing equations are nonlinear owing to the advective and the bottom friction terms, and they are solved at each time step iteratively by the Newton-Raphson method. Further model test runs have been made for the southern part of San Francisco Bay, California, USA (South Bay) where a two-dimensional model is justifiable. Due to the complex bathymetry, the hydrodynamic characteristics of the South Bay are dictated by the generally shallow basin which contains deep, relict river channels. Great care must be exercised to ensure that the conservation equations remain locally as well as globally accurate. Simulations have been made over several representative tidal cycles using this finite element model and the results compared with existing data. (Kosco-USGS)
W80-05449

A SEMI-IMPLICIT TWO-DIMENSIONAL MODEL OF ESTUARINE CIRCULATION,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
D-P. Wang, and D. W. Kravitz.
Journal of Physical Oceanography, Vol 10, No 3, p 441-454, March 1980. 14 Fig, 21 Ref.

Descriptors: *Estuaries, *Circulation, *Model studies, *Potomac River, Salinity, Water quality, Tidal effects, Mathematical models, Water circulation, Mixing, Analytical techniques, Analysis, Velocity, Tides, Water level fluctuations, Water levels, Spatial distribution, Profiles, Density, Tidal circulation, Wind driven circulation, Two-dimensional models.

A semi-implicit, two-dimensional (in a vertical plane) model was developed for circulation in the partially mixed estuary. Comparisons between the semi-implicit and explicit method were made in the simulation of tidal, wind-driven, and density-driven circulations. In general, the two model results are in good agreement in velocity and density computation; the semi-implicit method, however, fails to simulate the surface seiche oscillation. On the other hand, the semi-implicit method is more effi-

cient; depending on the horizontal space resolution, the semi-implicit method can result in orders of magnitude saving in computer time. Application of the semi-implicit model to the Potomac River indicates large longitudinal and vertical changes in tidal, density-driven, and wind-driven circulations, which suggests that two-dimensional (in a vertical plane) modeling is essential in the transport and mixing study. (Humphreys-ISWS)
W80-05475

ESTIMATES OF ENTRAINMENT IN THE FRASER RIVER PLUME, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Oceanography.
R. E. Cordes, S. Pond, B. R. de Lange Boom, P. H. LeBlond, and P. H. Crean.
Atmosphere-Ocean, Vol 18, No 1, p 15-26, 1980. 7 Fig, 2 Tab, 9 Ref.

Descriptors: *Entrainment, *Saline water, *Canada, *Oceanography, Model studies, On-site investigations, Mathematical models, Salinity, Data collections, Tides, Currents(Water), Salt balance, Analysis, Analytical techniques, *British Columbia, *Fraser River, *Strait of Georgia, Plumes.

During the past few years a number of studies concerned with the Fraser River plume have been made. From two of these it is possible to make independent estimates of the rate of entrainment of salt water from below into the plume. In the first study the entrainment rate was estimated by a salt balance method. In the second the entrainment rate was estimated from the observed divergence of the transport in the top 1.7 m of the plume. A value of $k = 0.0002$ was obtained for the entrainment coefficient relating the vertical to the horizontal velocity from salt conservation arguments at a series of profiles along the plume and from calculations of surface divergence, as measured by drifting drogues. It was also found that entrainment contributes significantly to the deceleration of the river plume after it issues into the Strait of Georgia. (Humphreys-ISWS)
W80-05478

LONGSHORE SEDIMENT TRANSPORT BY TIDAL CURRENTS,
Scripps Institution of Oceanography, La Jolla, CA.
R. J. Seymour.
Journal of Geophysical Research, Vol 85, No C4, p 1899-1904, April 20, 1980. 4 Fig, 3 Tab, 10 Ref.

Descriptors: *Sediment transport, *Littoral drift, *Tidal effects, *Model studies, Beaches, Coasts, Ocean current, Waves(Water), Surf, Mathematical models, Theoretical analysis, Analytical techniques, Water level fluctuations, Tides, *Oceanside(CA), Longshore currents.

A mechanism for longshore sediment transport outside the surf zone was proposed on the basis of the variation in bottom stress under stationary waves produced by tidal depth changes. The variation in stress is in phase with the longshore component of tidal velocity and was shown to produce a net transport counter to the direction of the advance of the tide along the coast. An analytical model for predicting tidal transport was developed and was applied to measurements of tidal currents and waves near Oceanside, California, over a 3-week period. The tidal transport rate decreases rapidly with depth, and the total net transport was shown to be a very small fraction of that anticipated from wave-driven currents at that location. Sediment deposited offshore of the normal range of the breaker zone during major storms will be transported alongshore by the proposed mechanism during periods of lower waves. The cumulative effect of this transport mechanism over broad, shallow shelf areas extending hundreds of kilometers could result in the movement of very significant quantities of sediment over geological time spans. (Humphreys-ISWS)
W80-05479

CHEMICAL AVAILABILITY OF MERCURY, LEAD, AND ZINC IN MOBILE BAY SEDIMENT SUSPENSIONS AS AFFECTED BY PH AND OXIDATION-REDUCTION CONDITIONS,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
For primary bibliographic entry see Field 5A.
W80-05486

THE DIFFUSION COEFFICIENTS OF SULFATE, AMMONIUM, AND PHOSPHATE IONS IN ANOXIC MARINE SEDIMENTS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-05490

ESTUARIES,
San Diego State Univ., CA. Dept. of Geological Sciences.
K. Bertine, J. K. Cochran, L. E. Cronin, W. P. Davis, and C. S. Martens.
In: Proceedings of a Workshop on Assimilative Capacity of U.S. Coastal Waters for Pollutants, Crystal Mountain, Washington, July 29-August 4, 1979, p 59-97, December 1979. 2 Fig, 1 Tab, 83 Ref, Working Paper No 1: Federal Plan for Ocean Pollution Research Development and Monitoring, FY 1981-1985. NOAA, Environmental Research Laboratories, Boulder, Colorado.

Descriptors: *Estuaries, *Water pollution effects, Environmental effects, Baseline studies, Waste disposal, Ecosystems, Water pollution sources, *Outer Continental Shelf, *Ocean dumping, Assimilative capacity.

Assimilative capacity is defined as the amount of a substance that the estuary can receive without damage to desired natural characteristics or uses of the estuary. Assimilative capacity varies from estuary to estuary, from segment to segment of a given estuary, and with time within any estuarine segment. It also varies with the kinds of wastes and the specific substances within them. Assimilative capacity, therefore differs with pollutant and with estuary: (1) The capacity for persistent toxic substances which may repeatedly recycle through estuarine processes (e.g., PCB's, pesticides) is very low; (2) the capacity for nutrients that can be incorporated and enhance desirable species production or processes desirable to the ecosystem and humans can be very high (e.g., to restore previously damaged habitats or enrich impoverished waters); (3) the capacity for combinations of sets of products entering an estuary which is heavily used for many purposes may be high or low. Determining assimilative capacity, which is a form of environmental modeling, requires a combination of data and should distinguish between the probability that an ecological unit will recover from perturbation (resilience) and the probability that it will succumb to perturbation (degradation). This chapter focuses on what quantities of different wastes can be released into estuaries without damage and how to improve the ability to estimate those quantities. (Sinha-OEIS)
W80-05569

MODERN BIOGENIC GAS-GENERATED CRATERS (SEAFLOOR 'POCKMARKS') ON BERING SHELF, ALASKA,
Geological Survey, Menlo Park, CA.
H. Nelson, D. R. Thor, and M. W. Sandstrom.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 110-131, October 1979. 5 Fig, 1 Tab, 30 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Seepage, *Craters, *Water pollution sources, Baseline studies, Alaska, Water pollution effects, Resources development, *Outer Continental Shelf, *Biogenic gas, Norton Sound, 'Seafloor pockmarks', Petroleum development, Environmental assessment.

Widespread occurrences of small (1-10 m diameter) circular pits or craters were observed in north-central Norton Sound of the Bering Sea epicontinental shelf; a few similar craters are also present near Port Clarence. These features resemble so-called 'pockmarks' observed on numerous other broad shelf areas. The origin of these sea-floor depressions has been ascribed to diverse processes such as permafrost melting, meteorite showers, and gas and fluid escape. It is postulated that the craters in Bering Sea are formed by present-day venting of biogenic gas generated and trapped in buried peaty mud. This paper describes this new occurence of craters or pockmarks and shows the geological, geophysical, geochemical, and geotechnical evidence in favor of this hypothesis. (Sinha-OEIS)
W80-05597

SUBSTRATE COMPETITION BETWEEN A SALT MARSH DIATOM AND A BACTERIAL POPULATION,
City Coll., New York. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-05616

AN ANALYSIS OF ANNUAL GROWTH AND PRODUCTIVITY OF JUNCUS ROEMERIANUS SCHEELE AND SPARTINA ALTERNIFLORA LOISEL IN COASTAL ALABAMA,
Alabama Univ., Birmingham.
For primary bibliographic entry see Field 2I.
W80-05618

FUNGI FROM SPARTINA ALTERNIFLORA IN RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-05620

LONG-TERM EFFECTS OF MANIPULATING LIGHT INTENSITY AND NUTRIENT ENRICHMENT ON THE STRUCTURE OF A SALT MARSH DIATOM COMMUNITY,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-05621

NITROGEN TRANSFORMATIONS AND UTILIZATION BY SPARTINA ALTERNIFLORA IN A LOUISIANA SALT MARSH,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 2I.
W80-05622

DISTURBANCE TOLERANCE AND COMPETITION IN BRACKISH MARSH PLANTS,
Princeton Univ., NJ.
For primary bibliographic entry see Field 2I.
W80-05623

ACTINOMYCETES OF A SALT MARSH,
Rutgers - The State Univ., New Brunswick, NJ.
For primary bibliographic entry see Field 2I.
W80-05625

ENERGY FLOW IN A HARPACTICOID COMMUNITY OF A SALT MARSH POOL,
Northeastern Univ., Boston, MA.
For primary bibliographic entry see Field 2I.
W80-05626

BIOLOGICAL DINITROGEN FIXATION (ACETYLENE REDUCTION) ASSOCIATED WITH FLORIDA MANGROVES,
University of South Florida, Tampa. Dept. of Biology.
For primary bibliographic entry see Field 2K.
W80-05627

UNDERGROUND BIOMASS PROFILES AND PRODUCTIVITY IN ATLANTIC COASTAL MARSHES,
Georgia Univ., Sapelo Island. Marine Inst.

For primary bibliographic entry see Field 2I.
W80-05629

THE DISTRIBUTIONS, TROPHIC ACTIVITIES, AND COMPETITIVE INTERACTIONS OF THREE SALT MARSH KILLIFISHES (PISCES: CYPRINODONTIDAE),
Lehigh Univ., Bethlehem, PA.
For primary bibliographic entry see Field 2I.
W80-05630

THE ROLE OF MACROBENTHIC ORGANISMS IN MERCURY, CADMIUM, COPPER AND ZINC TRANSFERS IN GEORGIA SALT MARSH ECOSYSTEMS,
Emory Univ., Atlanta, GA.
For primary bibliographic entry see Field 5B.
W80-05631

ABOVE-GROUND PRODUCTION OF MARSH CORDGRASS (SPARTINA ALTERNIFLORA) NEAR THE NORTHERN END OF ITS RANGE,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-05637

INHIBITION OF METHANOGENESIS IN SALT MARSH SEDIMENTS AND WHOLE-CELL SUSPENSIONS OF METHANOGENIC BACTERIA BY NITROGEN OXIDES,
Georgia Univ., Athens. Dept. of Microbiology.
For primary bibliographic entry see Field 2I.
W80-05643

NEST-SITE SELECTION OF WILLETS IN A NEW JERSEY SALT MARSH,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-05645

COMPARISONS OF SALT-MARSH FUCOID PRODUCTION ESTIMATED FROM THREE DIFFERENT INDICES,
State Univ. of New York at Stony Brook. Div. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-05648

AUTOTROPHIC AND HETEROTROPHIC NUTRITIONAL BUDGET OF SALT MARSH EPIPHYTIC ALGAE,
City Coll., New York. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-05650

MICROBIOLOGICAL AND PHYSICAL PROPERTIES OF SALT MARSH AND MICROECOSYSTEM SEDIMENTS,
South Carolina Univ., Columbia.
For primary bibliographic entry see Field 2G.
W80-05651

EDGE EFFECTS ON SALT MARSH ARTHROPOD COMMUNITY STRUCTURES,
Georgia Univ., Athens.
For primary bibliographic entry see Field 2I.
W80-05652

BLADE WIDTH OF LAMINARIA LONGIPES (PHAEOPHYCEAE, LAMINARIALES) AS AN INDICATOR OF WAVE EXPOSURE,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
For primary bibliographic entry see Field 2I.
W80-05656

THAILAND'S LITTORAL MUDFLATS AS INTERPRETED FROM LANDSAT IMAGERY,
Applied Scientific Research Corp., Bangkok (Thailand).
For primary bibliographic entry see Field 7B.
W80-05662

BIOLOGY OF INTERTIDAL SALDULA PALUSTRIS (DOUGLAS) ON THE OREGON COAST (HETEROPTERA: SALDIDAE),
Washington State Univ., Pullman. Dept. of Entomology.
For primary bibliographic entry see Field 2I.
W80-05663

ECONOMIC VALUE OF NATURAL COASTAL WETLANDS: A CRITIQUE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4C.
W80-05671

ARYLSULFATASE ACTIVITY IN SALT MARSH SOILS,
Georgia Univ., Athens. Dept. of Microbiology.
For primary bibliographic entry see Field 2K.
W80-05674

COMPARATIVE GAS EXCHANGE CHARACTERISTICS OF THREE MANGROVE SPECIES DURING THE WINTER,
California State Univ., San Diego. Dept. of Biology.
R. T. Moore, P. C. Miller, D. Albright, and L. L. Tieszen.
Photosynthetica, Vol 6, No 4, p 383-393, 1972. 3 Fig, 19 Ref.

Descriptors: *Mangrove swamps, *Seasonal, *Transpirations, Wetlands, Swamps, Plant physiology, Gases, Respiration, Photosynthesis.

Net photosynthesis, dark respiration, and transpiration rates and C02 compensation concentrations were measured on three mangrove species Rhizophora mangle, Avicennia germinans, and Laguncularia racemosa in southern Florida during the winter. Variability among plants was quite high for each species. Rhizophora, which tended to be the most variable in response to changing light and temperature conditions, had the lowest photosynthetic rates and the lowest temperature optimum. Laguncularia exhibited the highest photosynthetic rates. Both Avicennia and Laguncularia showed lower resistances to water vapor and C02 exchange than did Rhizophora throughout most of the light and temperature ranges studies. (Steiner-Mass)
W80-05677

SEDIMENTATION RATES ON TIDAL SALT MARSHES IN CONNECTICUT,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W80-05680

DUNE DISTRICT MANAGEMENT: A FRAMEWORK FOR SHOREFRONT PROTECTION AND LAND USE CONTROL,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
K. F. Nordstrom, and N. P. Psuty.
Coastal Zone Management Journal, Vol 7, No 1, p 1-23, 1980. 4 Fig, 3 Tab, 13 Ref.

Descriptors: *Dunes, *Land use, *Shore protection, *Coastal engineering, Barrier islands, Zoning, Erosion control, Coasts, Environmental control, Coastal structures, Management, Dune succession.

Many of the nation's barrier islands are currently undergoing severe erosion problems. The coastal dune component of the barrier island system is subject to mismanagement and destruction. Establishing a dune preservation district is a means to create natural dunes designed to provide protection to shorefront structures and to serve as wildlife habitats. Dune district zoning is derived from a conceptual framework that analyzes the numerous factors contributing to dune formation and modification. The district incorporates the appropriate uses of this dynamic environment. The establishment of a preservation district requires an analysis of the physical processes and the cultural modifications that affect dune formation and shoreline migration. This information can be used to determine the appropriate dune characteristics necessary for adequate protection and the maintenance required to continue this protection. This provides a sound basis for the establishment of zoning regulations designed to control long-term development in this high-hazard area. (Wilson-Florida)
W80-05693

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE ROLE OF DESALINATION IN WATER REUSE,
CH2M/Hill, Inc., Gainesville, FL.
O. K. Buros.
Desalination, Vol 32, No 1, p 305-308, January, 1980. 3 Ref.

Descriptors: *Water reuse, *Desalination, *Artificial recharge, Ground water recharge, Saline water intrusion, Ground water barriers, Wastewater treatment, Distillation, Reverse osmosis, Virgin Islands.

In reuse of water for potable or other purposes, desalination can act as (1) a barrier to undesired chemicals and microorganisms, (2) a method to reduce the total dissolved solids (TDS) before reuse, and (3) a method to concentrate valuable constituents for reuse and/or recovery. Artificial recharge of ground water using treated wastewater is a viable method of augmenting a potable water source. Desalination of treated wastewater by reverse osmosis has been used successfully in Orange County to provide low TDS water for a hydraulic barrier to seawater intrusion. In the Virgin Islands desalinated water is used for domestic needs, treated, and used for ground water recharge without further desalination. Seawater desalination can be accomplished by either distillation or reverse osmosis. However, with distillation, the TDS is nearly zero, permitting ground water recharge or other wastewater reuse applications without extra desalination costs. (Purdin-NWWA)
W80-05552

3C. Use Of Water Of Impaired Quality

PROGRESS IN THE USE OF DRIP IRRIGATION,
Kassel Univ. (Germany, F.R.). Dept. of International Agriculture.
For primary bibliographic entry see Field 3F.
W80-05548

THE ROLE OF DESALINATION IN WATER REUSE,
CH2M/Hill, Inc., Gainesville, FL.
For primary bibliographic entry see Field 3A.
W80-05552

3D. Conservation In Domestic and Municipal Use

WATER CONSERVATION VS. PRIVATE WELLS,
Illinois State Water Survey, Urbana.
R. T. Sasman, and Doughty.
American City & County, p 100, September, 1979.

Descriptors: *Water conservation, *Water wells, Water utilization, Legislation, Water levels, Monitoring, Observation wells, Droughts, Rationing(Water).

Long Grove, Illinois depends on private wells for its water supply. During droughts, some wells become dry. To avoid this in the future, village officials and residents developed a water conservation ordinance which enforced water use restrictions gradually based on water level monitoring. The use of three observation wells allows restrictions to be placed on one part of the village and not another. (Purdin-NWWA)
W80-05685

A TALE OF TWO WELL SYSTEMS.
American City and Country, p 99-101, September, 1979.

Descriptors: *Water supply, *Municipal water, *Ground water, *Water conservation, *Pumping, Hydroelectric power, Droughts, Water wells, South Dakota, Washington, Water utilization, Legislation, Well points, Water spreading, Water distribution(Applied), Water costs, Rationing(Water).

This article describes the well water supply systems of two cities, Sioux Falls, South Dakota and Spokane, Washington. During a drought in 1976, the city of Sioux Falls initiated a water conservation program. An ordinance was drafted which increased water use restrictions as the water table lowered. Water conservation kits were distributed to residents and a Citizens' Water Advisory Board was formed. Two well point systems and two large collector wells were installed and four additional small-diameter wells were constructed. After the drought, water spreading was used to recharge the aquifer. Spokane lies above a saturated aquifer 400 square miles in area and 280 feet thick. The quality of this water is so high that no treatment beyond chlorination is required. Although water shortage is not a problem, the cost of pumping up to 140 mgd is a major expense due to the 800-foot difference in elevation between the high and low points of the distribution network. Local hydroelectric power helped reduce the cost through a power exchange contract with the Washington Water Power Company. Ground water may become more valuable due to difficulties in obtaining surface water sources. Many communities are reviving wells that were once abandoned as uneconomical. (Purdin-NWWA)
W80-05700

3F. Conservation In Agriculture

IMPROVED WATER AND FERTILITY MANAGEMENT FOR IRRIGATION SYSTEMS – PHASE 2,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
P. E. Fischbach.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193832, Price codes: A05 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Final Report, May 1980. 96 p, 6 Tab, 2 Ref, 6 Append. OWRT B-037-NEB(1).

Descriptors: *Nebraska, *Irrigation efficiency, *Corn(Field), *Information exchange, Irrigation practices, Soil-water-plant relationships, Plant growth, Water requirements, Agriculture, Irrigation programs, Irrigation water, Beneficial use, Reasonable use, Irrigation wells.

Water and fertility management practices designed to maximize the efficiency of water use were developed for the Sandhills of Nebraska, an area being subjected to intensive irrigation agriculture development. The Sandhills extends over 20,000 square miles with a unique groundwater reservoir that is estimated at over a billion acre-feet, or more than 80 acre-feet of a water per acre, at depths of less than 300 feet in permeable aquifers. Center-pivot irrigation systems that cover 130 acre fields are increasingly being used to produce corn and to irrigate pastures. It is feared that wasteful irrigation practices may lower the water table of the area, creating many unwanted changes. The research on corn growth and irrigation practices was performed on a 15 acre plot at the Sandhills Agriculture Laboratory, Tryon, Nebraska. The plot was equipped with an irrigation well and a solid set sprinkler system. Data collected from various test plots of Pioneer 3780 corn included soil moisture content, plant height at various growth stages, ear count, phenology, leaf area, leaf temperature, dry matter production, and grain yields. Results show that 'optimum' irrigation is not full irrigation, especially from a yield and profit standpoint. Limited irrigation schedule recommendation on sandy soils are given along with a description of the technology transfer program used to implement these findings on an area-wide basis. (Seigler-IPA)
W80-05517

PROGRESS IN THE USE OF DRIP IRRIGATION,
Kassel Univ. (Germany, F.R.). Dept. of International Agriculture.
P. Wolff.
Arab Water World, Vol 4, No 20, p 67-62, March-April, 1980.

Descriptors: *Drip irrigation, *Technology, Water balance, Clogging, Water conservation, Soil water, Tensiometers, Fertilization, Impaired water use, Saline water, Automatic control, Economics, Labor.

Drip irrigation systems in the desert regions of the Middle East have made it possible for farmers to closely control the field/water balance. In temperate zones it is used to irrigate light or shallow soils. Where the supply of good quality water is becoming short and expensive, drip irrigation is becoming more popular. Outlet clogging by dirt particles has been reduced with the development of self-flushing dripers. A water saving of 30-50% can be achieved if the water supply is adjusted to the water requirement. The use of tensiometers and plastic sheets can save even more water. There still is a lack of data concerning optimum application quantities for nitrogen fertilizer and herbicides. Drip irrigation can successfully use saline water up to 3 mmho/cm due to concentration of the salt at the wetting front. Automatic operation techniques based on time and volume, evaporation tanks, or tensiometers can save labor and expense. The economic limits of drip irrigation need to be delineated if serious misdirection of capital investment in developing countries is to be avoided. (Purdin-NWWA)
W80-05548

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

AN AUTOMATIC HYDRAULIC STRUCTURE TO OPEN SAND PLUGS AT STREAM MOUTHS ON O'AHU,
Hawaii Univ., Honolulu. Water Resources Research Center.
J. K. Nishimura, and L. S. Lau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193873, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 117, June 1978. 71 p, 26 Fig, 4 Tab, 8 Plates. OWRT A-070-HI(2), 14-34-0001-7026, 8013.

Descriptors: *Hydraulic structures, *Flood control, Froude number, *Channel improvements, *Hawaii, *Hydraulic models, Design, *Sand plugs, *Sand removal, Stream mouths, Oahu(HI).

Numerous stream mouths on Oahu are affected by sand berm blockages which prevent free flow of storm waters to the ocean and cause the stream water level to rise rapidly; often overflowing of the stream banks and flooding of adjacent land areas result. To avoid this hazard, removal of the sand blockage prior to the arrival of peak flood flows is necessary. An automatic hydraulic structure which utilizes early arriving storm waters to hydraulically erode the sand berm has been developed during this study. A hydraulic model study of 1- to 15-scale Froudian model based on a generalized Oahu prototype stream channel was conducted to test physically the conceptual structure design. The hydraulic model structure performed effectively, causing rapid breaching of the sand berm under severe storm flow conditions. In all cases, overtopping of the sand berm, which would result in high stream stages and possible flooding, was avoided. Design recommendations and modifications have been developed to permit proper application of the structure to various stream mouth conditions.
W80-05537

4B. Groundwater Management

A FACILITY DESIGNED TO MONITOR THE UNSATURATED ZONE DURING INFILTRATION OF TERTIARY-TREATED SEWAGE, LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 5D.
W80-05444

ARTIFICIAL-RECHARGE INVESTIGATION NEAR AURORA, NEBRASKA, 2-YEAR PROGRESS REPORT,
Geological Survey, Lincoln, NE. Water Resources Div.
W. F. Lichtler, D. I. Stannard, and E. Kouma.
Available from: OFSS Bx 25425, Fed. Ctr. Denver, CO., 80225, Paper copy $8.00, Microfiche $3.50. Geological Survey open-file report 79-1492, 1979. 58 p, 20 Fig, 4 Tab, 12 Ref.

Descriptors: *Artificial recharge, *Groundwater recharge, *Nebraska, *Aquifer characteristics, *Injection wells, Monitoring, Water levels, Infiltration, Leakage, Impoundments, Canals, Irrigation, Water spreading, Water management(Applied), Water quality, Chemical analysis, Evaluation, *Aurora(Nebr), *Water-level declines.

This report presents the results of the first 2 years of a 4-year investigation of potential for artificial recharge and recharge methods that might be used to mitigate excessive aquifer depletion in Nebraska. A Quaternary sand-and-gravel aquifer near Aurora, Nebr., was recharged by injecting water through a well at a rate of approximately 730 gallons per minute for nearly 6 months. Total recharge was 530 acre-feet. Recharge was intermittent during the first 2 months, but was virtually continuous during the last 4 months. Buildup of the water level in the recharge well was 17 feet. The rate of buildup indicates that the well could have accepted water by gravity flow at more than 3,000 gallons per minute for at least 1 year. The cause of a continuing slow rise in water levels in the recharge well in contrast to nearly stable water levels in observation wells as close as 10 feet from the recharge well is as yet uncertain. The recharge water and the native ground water appeared to be chemically compatible. Infiltration rates from 24-foot-diameter surface impoundments ranged from 0.04 to 0.66 feet per day. The higher rates may have resulted in part from leakage down incompletely sealed holes that were drilled to install monitoring equipment. The investigation, including a report on the entire project, is scheduled for completion by 1980.
W80-05458

THE ROLE OF DESALINATION IN WATER REUSE,
CH2M/Hill, Inc., Gainesville, FL.
For primary bibliographic entry see Field 3A.
W80-05552

GROUND AND SURFACE WATER INTERACTION - LEGAL ASPECTS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
W. E. Kelly.
Journal of the Water Resources Planning and Management Division, Proceedings of the American

Society of Civil Engineers, Vol 106, No WR1, p 55-60, March, 1980. 1 Tab, 14 Ref.

Descriptors: *Surface-ground water relationships, *Legal aspects, *Withdrawals, *New England, Streamflow, Ponds, Water rights, Regulation, Common law, Reasonable use, Percolating water, Underground streams, Ground water, Water management(Applied).

Detrimental effects of ground water withdrawals on streams and ponds in New England have been minor except in south-eastern New England. Since the hydrogeology of this area is similar to the rest of New England, similar results can be expected if uncontrolled development occurs in other areas. Ground water withdrawals in New England have been relatively free of litigation and essentially unregulated. The common law doctrine of absolute ownership is followed in allocating ground water rights. Massachusetts regulates withdrawals by municipalities and by private supplies if they interfere with municipal supplies. The rule of reasonable use is applied to percolating waters. Connecticut has modified the absolute ownership rule in cases involving pollution but not in cases of withdrawal. Rhode Island has modified this rule by stipulating that 'a user may not purposely or negligently interfere with a neighbor's use of ground water'. New Hampshire applies the rule of reasonable use to both percolating water and underground streams. Maine and Vermont apply reasonable use rules to underground streams but retain the absolute ownership in cases involving percolating water. Ground water regulation can work if it is part of a management plan which recognizes the interrelationship of ground and surface water. (Purdin-NWWA)
W80-05553

A TALE OF TWO WELL SYSTEMS.
For primary bibliographic entry see Field 3D.
W80-05700

4C. Effects On Water Of Man's Non-Water Activities

URBAN STORM-RUNOFF MODELING--MADISON, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 2A.
W80-05442

BOGLAND UTILIZATION: AN IMPENDING IRISH LAND USE DILEMMA,
University of Northern Colorado, Greeley.
K. C. Kearns.
Scottish Geographical Magazine, Vol 94, No 2, p 103-112, September, 1978. 2 Fig, 26 Ref.

Descriptors: *Bogs, *Ireland, *Land management, Wetlands, Peat, Marsh management, Land use, Natural resources, Bogland utilization.

Past policy in Ireland has dictated that boglands be exploited chiefly for fuel. But recent experimentation has revealed considerable potential for agriculture, horticulture, and afforestation. Such revelations have stimulated controversy over future bogland utilization. The urgency of this dilemma is accentuated by the fact that most large Irish bogs will be exhausted in only thirty years. (Steiner-Mass)
W80-05657

ECONOMIC VALUE OF NATURAL COASTAL WETLANDS: A CRITIQUE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
L. A. Shabman, and S. S. Batie.
Coastal Zone Management Journal, Vol 4, No 3, p 231-247, 1978.

Descriptors: *Coastal marshes, *Value, *Wetlands, Monetary benefits, Marshes, Cost-benefit analysis, Economics, Land use, Benefits, Marsh management, Cost comparisons, *Critique(Report).

Recent estimates by J. Gosselink, E. Odum, and R. Pope of the economic value of natural wetlands have had considerable impact on analyses and discussions of public policies concerning natural wetlands management. However, these economic value estimates are neither conceptually nor empirically correct. First, these workers failed to recognize the nature of the process by which economic values are determined and made an illegitimate marriage of the principles of systems ecology and economic theory. Second, where Gosselink et al. attempted to apply proper economic principles, their calculations resulted in economic value estimates that are most likely in error. (Steiner-Mass)
W80-05671

PEAT WASTAGE IN THE EAST ANGLIAN FENS,
Agricultural Development and Advisory Service, Cambridge (England).
S. J. Richardson, and J. Smith.
Journal of Soil Science, Vol 28, p 485-489, 1977. 1 Tab, 8 Ref.

Descriptors: *Fens, *Peat, *Use rates, Wetlands, Fuels, Marshes, Land use, Great Britain.

Measurements of the decline in peat depth between 1941 and 1971 were taken at 14 sites across the East Anglian Fens. Rates of wastage in the period before 1955 and in the more recent period varied widely from site to site. Wastage rates were higher at all sites but one, in the period before 1955. The mean value for wastage rate over the entire period covered was 1.37 (+ or - 0.78) cm/yr. (Steiner-Mass)
W80-05681

THE LONG ISLAND RESPONSE TO THE RISKS OF OUTER CONTINENTAL SHELF OIL PRODUCTION,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 6E.
W80-05694

4D. Watershed Protection

DETERMINATION OF SEDIMENT FILTRATION EFFICIENCY OF GRASS MEDIA (VOLUME I) SEDIMENT FILTRATION EFFICIENCY OF CONTINUOUS GRASS MEDIA,
Kentucky Water Resources Research Inst., Lexington.
D. T. Kao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-216666, Price codes: A04 in paper copy, A01 in microfiche. Research Report No 124, 1980. 51 p, 17 Fig, 5 Tab, 11 Ref. OWRT A-069-KY(1), 14-34-0001-7037(FY1976), 14-34-0001-7038(FY1977), 14-34-0001-8019(FY1978), 14-34-0001-9019(FY1979).

Descriptors: *Sediment transport, *Suspended load, *Bed load, *Grassed waterways, *Trap efficiency, Grass filter, Sediment filtration, Filtration efficiency.

Vegetative filters serve the purpose of retarding flow. As a result the sediment carrying power of flowing water in a vegetated channel is greatly reduced and silting takes place along the section where the vegetation is planted. The mechanism of the filtering action of real or artificial vegetation can be described by a simple principle, in that a gross reduction of turbulent fluctuation of the fluid is involved. This in turn allows the sediment particles to settle under the force of gravity more readily. In the case of nonsubmerged flow, solid particles may settle out even faster due to the lengthening of the path the particles travel as they move with the fluid around the vegetation blades and the creation of zero velocity regions in front and behind the vegetation stems. In order to determine the actual sediment trapping efficiency, a series of experimental tests were conducted under various flow conditions in a channel with continuous and discrete vegetative covers. The research results will be presented in three parts: (1) sediment filtration efficiency of continuous grass media; (2) bedload behavior in continuous and discrete vegetative filters; and (3) trapping of suspended solids by discrete vegetative filters. This research report addressed the effectiveness of the vegetative filter in trapping suspended solids when the filter is arranged in a continuous manner. (Huffsey-Kentucky)
W80-05408

RIPARIAN FORESTS IN CALIFORNIA: THEIR ECOLOGY AND CONSERVATION.
California Univ., Davis. Inst. of Ecology.
For primary bibliographic entry see Field 2E.
W80-05606

BOGLAND UTILIZATION: AN IMPENDING IRISH LAND USE DILEMMA,
University of Northern Colorado, Greeley.
For primary bibliographic entry see Field 4C.
W80-05657

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

MULTIELEMENT ANALYSIS OF WATER THROUGH OSMOTIC REDUCTION AND X-RAYS,
California Univ., Davis. Dept. of Physics.
T. A. Cahill, D. J. Shadoan, and C. C. Couper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-216690, Price codes: A02 in paper copy, A01 in microfiche. California Water Resources Center, University of California, Davis, Technical Completion Report, May 1980, 10 p, 1 Fig, 3 Tab. (California Water Resources Center Project UCAL-WRC-W-550). OWRT-A-069-CAL(1).

Descriptors: *Reverse osmosis, *X-ray analysis, Filtration, Water vapor, *Trace elements, Water analysis, Chemical analysis, Water quality, *Pollutant identification.

A reverse osmosis or vapor filtration system has been designed, built, and tested for reduction of water samples into particulate and solute fractions. The samples are reduced to 14cm2 circles of deposit on Nuclepore and cellophane substrates with little loss of material, suitable for direct introduction into x-ray analysis systems (x-ray fluorescence and/or particle induced x-ray emmission). Sensitivities achieved depend on total mass loading in each phase, but ppb levels of transition metals in drinking water can be accomplished. Light element sensitivities are poorer due to chlorine interference in the cellophane. The system is being evaluated on a variety of unpolluted and polluted waters. (Snyder-California)
W80-05403

GAS EXCHANGE, PHOTOSYNTHETIC UPTAKE, AND CARBON BUDGET FOR A RADIOCARBON ADDITION TO A SMALL ENCLOSURE IN A STRATIFIED LAKE,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 2H.
W80-05412

RADIOCHEMICAL ANALYSIS OF ORTHOPHOSPHATE CONCENTRATIONS AND SEASONAL CHANGES IN THE FLUX OF ORTHOPHOSPHATE TO SESTON IN TWO CANADIAN SHIELD LAKES,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2H.
W80-05429

SEDIMENT BACTERIA AS A WATER QUALITY INDICATOR IN THE LYNNHAVEN ESTUARY,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
C. W. Erkenbrecher, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-192354, Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Bulletin 126, June 1980. 118 p, 34 Fig, 29 Tab, 79 Ref, Append. OWRT A-080-VA(1).

Descriptors: *Fecal coliforms, *Coliforms, *Total coliforms, *Fecal streptococci, Suspended sediment, *Water quality, *Estuaries, *Bacteria, *Sediments, Water quality indicator, Lynnhaven River(VA).

The objectives of this study were to document the spatial and temporal distribution and composition of bacteria in the sediments and overlying waters of Virginia's Lynnhaven estuary, and to evaluate the effects of nonpoint pollution on the estuarine ecosystem. The total suspended solid load varied greatly (8.8 mg/l to 148.0 mg/l). Broad ranges were also recorded for salinity (0.09 to 22.90 ppt) and dissolved oxygen as percent saturation (38.3 to 157.3 percent). The higher salinity water and coarser sediment of the inlet site showed lower overall counts of indicator bacteria counts than the headwater sites, where freshwater runoff and decreased tidal action were characteristic. The sediment throughout the estuary had a broad range in total coliforms, fecal coliforms, and fecal streptococci. The densities of benthic indicator bacteria, when expressed on a volumetric basis, were significantly greater than counts in the overlying waters. These counts were indicative of a fecally polluted system. Based on calculated fecal Coliform to fecal streptococci ratios, the primary sources of the Lynnhaven's bacterial pollution appeared to be typical of urban and agricultural runoff. The sediments in the Lynnhaven serve as a reservoir for indicator bacteria in densities sufficient to pose potential health hazards. Disturbance in the uppermost sediment layer could cause the resuspension of existing fecal pollution. The results of this study show the urgent need to study more closely the significance of disease-causing bacteria in sediments characterized by high levels of fecal pollution.
W80-05467

RELIABILITY OF WATER ANALYSIS KITS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd.
Transactions of the American Fisheries Society, Vol 109, No 2, p 239-243, March 1980. 5 Tab, 5 Ref.

Descriptors: *Water chemistry, *Analytical techniques, *On-site data collections, *Chemical analysis, Equipment, Evaluation, Sampling, Water quality, Data processing, Regression analysis, Hardness(Water), Carbon dioxide, Alkalinity, Nitrogen, Nitrites, Nitrates, Phosphates, Sulfates, Chlorine, Turbidity, Pollutant identification, Water pollution, Water analysis kits.

Water analysis kits (Bausch and Lomb SpectroKits(TM), Ecologic test kits, and CHEMetrics test kits) were evaluated by comparison with standard analytical methods. Results of analyses with water analysis kits were highly correlated with concentrations of standard solutions. In replicate analyses of pond water, kits gave results that often differed from, and usually were less precise than, standard methods. When large series of water samples were analyzed, values from kits and standard methods were highly correlated (r greater than 0.85; P less than 0.01), but regression intercepts seldom were 0 and slopes seldom were 1.0. Thus, water analysis kits are not suitable when high accuracy and precision are necessary, but kits are sufficiently reliable in many applications. (Sims-ISWS)
W80-05481

CHEMICAL AVAILABILITY OF MERCURY, LEAD, AND ZINC IN MOBILE BAY SEDIMENT SUSPENSIONS AS AFFECTED BY PH AND OXIDATION-REDUCTION CONDITIONS,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
R. P. Gambrell, R. A. Khalid, and W. H. Patrick, Jr.
Environmental Science and Technology, Vol 14, No 4, p 431-436, April 1980. 4 Fig, 4 Tab, 38 Ref. DACW-39-74-C0076.

Descriptors: *Chemical analysis, *Sediments, *Metals, *Bays, Water pollution sources, Pollutants, Laboratory tests, Methodology, Analytical techniques, Dredging, Mercury, Lead, Zinc, Hydrogen ion concentration, Data collections, Analysis, Oxidation-reduction potential, *Mobile Bay.

Mobile Bay sediment material was incubated under conditions of controlled pH (5.0, 6.5, and 8.0) and redox potential (-150, +50, +250, and +500 mV) to determine the effects of these physicochemical parameters on the chemical form of added labeled mercury and lead as well as indigenous lead and zinc. After equilibrating for 2 weeks under controlled pH-redox potential conditions, suspension aliquots were subjected to a chemical fractionation procedure to determine levels of metals in total soluble, noncationic soluble, exchangeable, reducible, and chelate extractable forms. The soluble and/or exchangeable fractions, representing readily available forms, were found to represent only a small proportion of each metal. A large proportion of each metal was found in potentially available forms. An altered physicochemical environment influenced levels of the metals in most of the general chemical forms studied. The responses of metal levels in the selected chemical forms to controlled pH and redox potential conditions tended to differ for the three metals studied, indicating that the immobilizing processes do not affect the metals to the same degree. It was concluded that the physicochemical condition of contaminated dredged materials at a disposal site may influence transformations of these metals among readily available and potentially available chemical forms. (Humphreys-ISWS)
W80-05486

TRACE METALS IN HUMIC AND FULVIC ACIDS FROM LAKE ONTARIO SEDIMENTS,
Canada Centre for Inland Waters, Burlington (Ontario); and National Water Research Inst., Burlington (Ontario).
J. O. Nriagu, and R. D. Coker.
Environmental Science and Technology, Vol 14, No 4, p 443-446, April 1980. 5 Tab, 25 Ref.

Descriptors: *Lake Ontario, *Lake sediments, *Acids, *Metals, Humic acids, Fulvic acids, Copper, Lead, Nickel, Chromium, Cobalt, Cadmium, Manganese, Zinc, Water pollution sources, Pollutants, Chemical analysis, Analytical techniques, Data collections.

The distribution of trace metals in humic acid, fulvic acid, and the associated sediments from Lake Ontario has been determined. The principal metal components of the humic acids are copper (1000-1600 micrograms/g) and iron (1000-2000 micrograms/g). Metals enriched in the humic and fulvic acids compared to the entrapping sediments include Cu, Pb, Ni, and Cr, whereas the concentrations of Co, Cd, Mn, and Zn are much less in these acids. It is estimated that nearly all the Cu, about 5-10% of the Pb, Cr, and Ni, and less than 5% of the Co, Cd, and Zn in the sediments are bound to the organic matter. Evidence is presented to show that the humic and fulvic matter have acquired most of their trace metal burden in the overlying water. (Humphreys-ISWS)
W80-05487

THE HARMONIZATION OF THE MONITORING OF THE QUALITY OF RIVERS IN THE UNITED KINGDOM,
Department of the Environment, London (England).
E. A. Simpson.
Hydrological Sciences Bulletin, Vol 25, No 1, p 13-23, March 1980. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Water quality, *Monitoring, *Rivers, Sampling, Networks, Chemical analysis, Analytical techniques, Pollutants, Pollutant identification, Water pollution, Chemicals, Water temperature, Metals, Heavy metals, Data storage and retrieval, *England, *Scotland, *United Kingdom.

In the United Kingdom the need to monitor the quality of all but the smallest rivers as they enter tidal waters has been established. There is a need both to satisfy international obligations and to provide information on river quality. To satisfy this need, the Harmonized Monitoring Scheme was set up. A network of sampling points has been established which will allow all important rivers to be sampled at or a little above the tidal limit. A similar network has been established for major tributaries with the sampling points being at the confluence or a little way up the tributary from it. Nearly all sampling points are associated with flow gaging facilities so that load as well as concentration can be determined. The scheme lays great stress on the need to produce results of adequate accuracy. To ensure that such accuracy is maintained, the Harmonized Monitoring Scheme includes a continuing interlaboratory calibration of participating laboratories. (Sims-ISWS)
W80-05499

ASSESSMENT OF SAR FOR OIL POLLUTION SURVEILLANCE IN THE ICE ENVIRONMENT,
REMOTEC Applications Inc., St. John's (Newfoundland).
S. Parashar, G. Stapleton, R. Worsfold, R. O'Neil, and L. Gray.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 3, p 99-123, 1979. 13 Fig, 2 Tab, 41 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Oil pollution, *Sea ice, *Radar, *Monitoring, Path of pollutants, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, Imaging radar, Synthetic Aperture Radar(SAR), Surveillance, Ice environment.

The utility of radar for oil pollution surveillance in temperate oceans is established to a certain extent but its corresponding ability over ice and ice-infested waters has yet to be demonstrated. A study was undertaken to assess potentials and limitations associated with the use of active microwave sensors for detecting and monitoring oil pollution in the ice environment. It appears the presence of oil in the ice environment is likely to be detected through identification of indirect subtle clues, i.e., changes in texture and tone such as those produced by increased melting of oil covered ice areas in comparison with oil free areas. As the tonal and textural contrast due to the presence of oil is expected to be subtle, the variability of signatures in the ice environment was investigated and results are presented. Four-channel synthetic aperture radar (SAR) imagery of ice obtained under C-CORE's Project SAR'77 was studied through manual and digital analyses. It appears simple image enhancement and processing techniques may provide means for increasing the likelihood of oil spill detection and reducing the false alarm risk. Based on these analyses, utility of SAR for oil pollution surveillance in the ice environment is assessed and discussed. (Sinha-OEIS)
W80-05509

OIL IN MOVING PACK ICE - LABORATORY STUDY,
M. Metge, and A. S. Telford.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 3, p 255-264, 1979. 4 Fig, 7 Ref. The University of Trondheim, The Norwegian Institute of Technol-

ogy, Trondheim, Norway.

Descriptors: *Ice, *Oil pollution, *Path of pollutants, *Laboratory tests, *Sea ice, Laboratory tests, Exploration, Water pollution effects, Environmental effects, Arctic, Resources development, *Outer Continental Shelf, Petroleum development, Pack ice.

There is a small risk that during offshore petroleum exploration in Canada's Eastern Arctic, a subsea blow out could release oil and gas under moving ice. Predictions of the potential environmental effects of the oil and development of oil spill counter-measures depend strongly on an adequate knowledge of the behavior of oil in moving ice. This paper describes a series of three laboratory tests, largely qualitative in nature, during which two different crude oils were released under moving ice. The main observations were: During interactions between ice floes, the oiled slush, being more viscous than either oil or slush alone, was squeezed up onto the edges of the floes. This is one of the many mechanisms by which oil can become encapsulated in the ice. A water-in-oil emulsion formed during the tests even though the agitation was rather gentle. Some emulsion may have formed during melting of the ice in the sun, where it appeared as a light brown scum on top of the ice. Other observations, relative to the spreading of the oil, the effect of wind and waves and countermeasures are also described. (Sinha-OEIS)
W80-05512

OPERATIONAL METHODS FOR ANALYSIS OF AGRICULTURAL NONPOINT SOURCE POLLUTION,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
D. A. Haith, and L. J. Tubbs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193840, Price codes: A04 in paper copy, A01 in microfiche. Center for Environmental Research, Cornell University Technical Completion Report, March 1980. 60 p, 9 Fig, 20 Tab, 58 Ref. OWRT B-055-NY(3), 14-34-0001-7169.

Descriptors: *Water quality, *Model studies, *Water pollution sources, *Nonpoint source pollution, *Agricultural runoff, Nitrogen, Phosphorus, Sediment, *Pesticides, Watersheds(Basins), Path of pollutants, Forecasting.

Three mathematical models were developed to estimate nutrient and pesticide losses from croplands. The simplest is a set of equations or loading functions designed to estimate daily dissolved and solid-phase nitrogen and phosphorus losses in runoff from large heterogeneous agricultural watersheds. This model was tested using data from a 391-km2 Pennsylvania watershed. The second model predicts edge-of-field dissolved and solid-phase losses of pesticides in runoff. This model includes exponential decay and linear adsorption functions and was tested with data for atrazine losses from two small Georgia catchments. The final model, which is the Cornell Nutrient Simulation (CNS) model is the most complex of the three models, and predicts dissolved and solid-phase nitrogen and phosphorus in cropland runoff and dissolved nitrogen in percolation. Unlike the loading functions model, computations are based on soil water and nutrient mass balances. Testing of the CNS model on field sites in New York and Georgia indicated that predicted nutrient losses are reasonably accurate and capture significant variations between fields and climatic regions. All of the three models are designed to be used with secondary data sources and do not require calibration. The first model is a general tool for estimating the magnitudes of agricultural nonpoint sources, and the second and third models provide mechanisms for evaluating alternative water pollution control practices.
W80-05515

THE DETECTION OF MUTAGENIC POLLUTANTS IN AQUATIC AND MARINE ENVIRONMENTS: STUDIES OF THE MILLERS RIVER AND BOSTON HARBOR,
Massachusetts Univ., Amherst. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W80-05541

SHALLOW FAULTING, BOTTOM INSTABILITY, AND MOVEMENT OF SEDIMENT IN LOWER COOK INLET AND WESTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W80-05594

BIOGENIC AND THERMOGENIC GAS IN GAS-CHARGED SEDIMENT OF NORTON SOUND, ALASKA,
Geological Survey, Menlo Park, CA.
K. A. Kvenvolden, C. H. Nelson, D. R. Thor, M. C. Larsen, and G. D. Redden.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 95-109, October 1979. 3 Fig, 2 Tab, 21 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sediments, *Seepage, *Gases, *Hazards, *Water pollution sources, Geology, Geochemistry, Geophysics, Baseline studies, Alaska, Construction, Environmental effects, Resources development, *Outer Continental Shelf, Norton Sound, Biogenic gas, Thermogenic gas, Environmental assessment, Hydrocarbons, Petroleum development.

Geophysical, geologic and geochemical evidence all indicate that gas-charged, near-surface sediment is present in Norton Sound, Alaska. Some sediment is charged with methane that is probably derived from microbial processes operating on Pleistocene peaty mud beneath a thin veneer of Holocene sediment from the Yukon River. At Site 3 sediment is charged with C02, which seeps into the water column. This C02 carries with it a minor component of hydrocarbon gases and gasoline-range hydrocarbons. The chemical and isotopic composition of the sediment gases indicate that they are derived from thermal sources operating at depth within Norton Basin. The gases probably migrate up faults eventually reaching the surface as a seep. The hydrocarbons apparently are derived through processes similar to or the same as those that produce petroleum. Data do not indicate whether a significant accumulation of petroleum is present at depth. The ease of penetration by the vibracorer into the gas-charged sediment suggest that the presence of gas reduces the stability of the sediment. Areas where sediments are charged with biogenically and thermogenically derived gas may be hazardous for any future engineering developments in the area. (Sinha-OEIS)
W80-05596

QUALITY ASSURANCE PROGRAM FOR TRACE PETROLEUM COMPONENT ANALYSIS,
NOAA National Analytical Facility, Seattle, WA.
W. D. MacLeod, Jr., D. W. Brown, M. M. Krahn, P. Prohaska, and D. Gennero.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 479-511, October 1979. 2 Tab, 15 Ref, 3 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Pollutant identification, *Analytical techniques, *Baseline studies, *Water pollution, *Quality control, Testing procedures, Oil pollution, Environmental effects, Alaska, Resources development, *Outer Continental Shelf, Petroleum development, Hydrocarbons.

The objectives of this study are to coordinate and conduct an analytical quality-assurance program that compares results among Principal Investigators (PI's) within the OCSEAP and to recommend procedural modifications for improved analytical techniques, particularly those dealing with polar organic compounds associated with petroleum. Effective measurement of hydrocarbons in marine sediments requires standardized extraction procedures that are efficient and reproducible. Hence, studies comparing existing state-of-art methodology with new methodology provides valuable information on this technology. Once the major procedures were interrelated statistically, using the Interim Reference Material (IRM) as test sample, the way was paved for interlaboratory calibration efforts. If most of these laboratories report back analytical data on most of these hydrocarbons, along with typical blank analyses, it should be possible to make useful statistical statements about the quality assurance of OCS hydrocarbon analyses. Petroleum also contains many organic compounds more polar than hydrocarbons. Analytical methodology to extract and analyze toxic polar organics at trace levels remains largely unexplored with respect to samples from the marine environment. Hence, establishment of efficient, statistically-proven, ultra-sensitive analytical procedures for these compounds is important to the OCS program. (Sinha-OEIS)
W80-05602

TOXICITY OF LANDFILL LEACHATES,
Babichuk Construction Ltd., Calgary (Alberta).
R. D. Cameron, and F. A. Koch.
Journal of the Water Pollution Control Federation, Vol 52, No 4, p 760-768, April, 1980. 5 Fig, 7 Tab, 3 Ref.

Descriptors: *Toxicity, *Leachate, *Landfills, Attenuation, Chemical analysis, Hydrogen ion concentration, Precipitation(Atmospheric), Recycling, Water pollution treatment.

This paper is unique in that it assesses leachate toxicity using data on 'natural' landfill leachates and 'synthetic' leachates from lysimeter studies. Landfill leachates are highly toxic at the discharge point in spite of attenuation. Agents of toxicity are easily identifiable in landfill leachates and can be correlated with leachate chemical composition. Over 94% of observed toxicity is due to variations in un-ionized ammonia, tannin, copper, and hydrogen ion concentration. Toxicity measurements can be misleading due to the effects of pH. Thus, in addition to testing at pH 7, toxicity should be measured at the original pH. The logarithmic decay of toxicity is accelerated under conditions of high precipitation. Recycling of leachate attenuated toxicity five times as fast per unit equivalent precipitation as precipitation alone did. Physical treatment of leachate with peat and combined physical/chemical treatment were both shown to be effective in reducing leachate toxicity. (Purdin-NWWA)
W80-05654

5B. Sources Of Pollution

THE DISTRIBUTION AND ABUNDANCE OF POLYCHLORINATED BIPHENYLS IN SURFACE WATERS OF BLOOMINGTON, INDIANA,
Indiana Univ. at Bloomington. Dept. of Geology.
M. L. Epstein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-216716, Price codes: A05 in paper copy, A01 in microfiche. MA thesis, May 1979. 71 p, 15 Fig, 31 Tab, 22 Ref. OWRT-C-7681(No 7256)(1).

Descriptors: *Polychlorinated biphenyls, *Surface waters, *Gas chromatography, *Runoff, *Path of pollutants, Storm runoff, Rainfall-runoff relationships, Indiana, *Bloomington(IN), *Water analysis, Streamflow.

During or immediately following major meteorologic events, 1.89 liter grab samples were obtained from 10 major stream sampling sites located in and around the Bloomington area between October 1976 and August 1978. These samples were extracted with carbon tetrachloride and analyzed by gas chromatography and gas chromatography

coupled with mass spectrometry. Polychlorinated biphenyls (PCBs) were found at all the major sites and ranged in concentration from less than 1 microgram per liter (ug/l) to 70 ug/l. The greatest concentrations were found downstream from the Winston-Thomas Waste Water Treatment Plant on Clear Creek. Sequential grab samples provided the opportunity to study the concentration-discharge relationship, which was found to be dependent upon the source of the PCBs. The concentration of PCBs at one site located immediately downstream of the WWTP decreased with an increase in flow; all other sites exhibited the opposite relationship. At all sites, total mass transport of PCBs increased during periods of elevated stream discharge; the amount by which the mass increased was also found to be dependent upon the source.
W80-05401

INORGANIC CHEMISTRY OF URBAN RUNOFF AND HYDROLOGIC RELATIONSHIPS, BLOOMINGTON, INDIANA,
Indiana Univ. at Bloomington. Dept. of Geology.
D. W. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-216708, Price codes: A06 in paper copy, A01 in microfiche. MA Thesis, October 1979. 93 p, 25 Fig, 8 Tab, 20 Ref, 4 Append. OWRT-C-7681(No 7256)(2).

Descriptors: *Pollutants, Storm runoff, *Water quality, *Gaging stations, Discharge(Water), Hydrographs, Parameters, Concentrations, Karst, Rainfall-runoff relationships, Path of pollutants, Sampling, Water analysis, Effluents, *Urban runoff, Indiana, *Bloomington(IN).

Identification and quantification of key pollutants and the impact of storm-water runoff was carried out in the karst-controlled landscape of Bloomington, Indiana, and surrounding suburban and agricultural areas. Water quality data were obtained from 10 gaging stations and 5 subsites before and after rainfalls of differing intensities and duration. Concentrations of NO3, NH3, PO4, F, K, Fe, and Mn were increased at the sewage treatment plant and storm sewer outfalls and for several miles downstream. Values of Na, Cl, SO4, conductivity, and Zn were highest in the runoff from the most developed areas. There were no increases of NO3, NH3, PO4, and suspended sediment correlating to an increased proportion of impervious cover. Simple dilution was the reason concentrations of most parameters decreased with increasing discharge with the exception of suspended sediment, turbidity and ions related to the particulate load which increased with increasing discharge. Improvement of a mathematical relationship of concentration to discharge was realized when samples taken on the rising limb of the discharge hydrograph were separated from those on the falling limb. The transport of dissolved chemicals through a storm runoff period is extremely complex and lacks uniformity, necessitating individual treatment of parameters.
W80-05402

OCCURRENCE AND ACTIVITY OF IRON AND SULFUR-OXIDIZING MICROORGANISMS IN ALKALINE COAL STRIP MINE SPOILS,
National Bureau of Standards, Washington, DC.
G. J. Olson, G. A. McFeters, and K. L. Temple.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-204340, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Bozeman,

Descriptors: *Sulfur bacteria, *Strip mines, *Coal mines, *Acid mine water, *Metals, Spoil banks, Thiobacillus ferrooxidans, Groundwater, Overburden, Alkaline soils, Microorganisms, Reclamation, Hydrogen sulfide, Path of pollutants, Montana, Sulfur cycle, Geomicrobiology, Pyrite oxidation, Metal precipitation, Southeastern Montana, Western coal.

Spoils samples collected from a coal strip mine in southeastern Montana were examined for populations and activities of iron- and sulfur-oxidizing bacteria. Spoils examined were of three types: (1) acidic pyrite-rich waste coal, (2) oxidation halo material, and (3) alkaline, which was the most widespread type. Bacterial numbers, sulfur oxidation, and 14CO2 uptake activity declined to low levels in the summer when spoils were dry. Even in wetter spring months pyritic spoils contained relatively low numbers of acidophilic iron- and sulfur-oxidizing bacteria, probably indicative of water stress since the same spoils incubated with excess water or dilute mineral salts showed considerably greater bacterial numbers and activity. Certain wells in coal and spoils aquifers contained substantial populations of iron-oxidizing acidophilic bacteria. However, these wells were always of alkaline or neutral pH indicating that bacterial pyrite oxidation occurred in localized areas where groundwaters contacted either replaced spoils or coal which contained either pyrite or other metal sulfides. Bacterial activity may contribute to trace metal and sulfate leaching which occur in the area. (Hunt-Montana)
W80-05404

THE OCCURRENCE AND BEHAVIOR OF HALOMETHANES IN THE AQUATIC ENVIRONMENT,
Michigan State Univ., East Lansing. Inst. of Water Research.
F. M. D'Itri, and S. W. Kaczmar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-190317, Price codes: A07 in paper copy, A01 in microfiche. Project Completion Report, April, 1980. 125 p, 12 Fig, 8 Tab, 4 Append. OWRT A-100-MICH(1), 14-34-0001-9024.

Descriptors: *Halogens, *Chlorine, *Waste water treatment, *Halomethanes, *Chlorination, Chloroform, Tertiary treatment, Europium, Dysprosium, Bromine, Ion tracer, Neutron activation, Michigan, *Red Cedar River(MI), *Sewage tracer; Adsorption experiments, Haloform oxygen gas transfer, East Lansing(MI), Sewage treatment plant.

This study was conducted to determine the impact of the release of halomethanes produced during the chlorination of wastewater that was discharged into the Red Cedar River. The levels of chloroform in sewage were monitored as it passed through the East Lansing sewage treatment plant. The production of halomethanes during chlorination was demonstrated by an increase from <1.0 ug/l to 16.0 ug/l chloroform following chlorination of tertiary treated sewage. The Red Cedar River was sampled and analyzed for halomethanes. The development of a sewage tracer was investigated to provide a means to differentiate changes in haloform levels in the river due to dilution from those occurring as a result of volatization or adsorption. The methods researched were neutron activation analysis of europium, dysprosium and bromine, as well as a fluorescence and chloride ion tracer. The neutron activation methods were the most sensitive, with limits of detection of 1.0 ug/l dysprosium and 35.0 ug/l europium. Laboratory controlled haloform/oxygen gas transfer and adsorption experiments were conducted to predict the persistence of haloforms in a river system. Oxygen to haloform gas transfer ratios and a measured log sediment-water partition coefficient were used to calculate Red Cedar River haloform volatization half-lives.
W80-05407

EFFECTS OF A WINDSTORM AND FOREST FIRE ON CHEMICAL LOSSES FROM FORESTED WATERSHEDS AND ON THE QUALITY OF RECEIVING STREAMS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, R. W. Newbury, K. G. Beaty, J. Prokopowich, and T. Ruszczynski.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 3, p 328-334, March 1980. 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Forest fires, *Winds, *Nutrients, *Runoff, *Canada, Water quality, Effects, Streamflow, Phosphorus, Nitrogen, Potassium, Water yield, Forest watersheds, Watersheds(Basins), Demonstration watersheds, Precipitation(Atmospheric), Data collections, On-site data collections, Data processing, Nutrient losses, Windstorms.

A severe natural windstorm followed by a high intensity forest fire caused significant increases in runoff and in losses of nitrogen, phosphorus, and potassium from two small Precambrian watersheds. Both the windstorm and the fire had significant effects on water and chemical yields. Water yields in the two basins were 1.6 and 1.8 times the pre-impact means, respectively, in the year after the burn. Maximum chemical losses were observed for nitrate, with values of 3.4 and 9 times the pre-impact means for the two basins in the year after the burn. Increases in annual yields of most chemical parameters were 1.1 to 2.9 times the background. Both increased concentrations and increased flow volumes appear to be responsible for the increased nutrient losses. (Sims-ISWS)
W80-05421

DENITRIFICATION IN LAKE 227 DURING SUMMER STRATIFICATION,
Manitoba Univ., Winnipeg. Dept. of Microbiology.
For primary bibliographic entry see Field 2H.
W80-05427

REVISION OF THE DOCUMENTATION FOR A MODEL FOR CALCULATING EFFECTS OF LIQUID WASTE DISPOSAL IN DEEP SALINE AQUIFERS.
INTERA Environmental Consultants, Inc., Houston, TX.
For primary bibliographic entry see Field 6A.
W80-05437

HYDROLOGIC ENVIRONMENT OF THE SILURIAN SALT DEPOSITS IN PARTS OF MICHIGAN, OHIO, AND NEW YORK,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5E.
W80-05443

WATER QUALITY OF THE FRENCH BROAD RIVER, NORTH CAROLINA--AN ANALYSIS OF DATA COLLECTED AT MARSHALL, 1958-77,
Geological Survey, Raleigh, NC. Water Resources Div.
C. C. Daniel, III, H. B. Wilder, and M. S. Weiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-119860, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-87, 1979. 53 p, 15 Fig, 14 Tab, 19 Ref.

Descriptors: *Water quality, *North Carolina, *Streams, *Water analysis, Analytical techniques, Data collections, Chemical analysis, Water chemistry, Surface waters, Flow characteristics, Suspended load, Bacteria, Water pollution sources, Evaluation, Hydrograph analysis, *French Broad River(NC), *Western North Carolina.

An investigation of water quality in the industrialized French Broad River basin of western North Carolina has identified water-quality variations, the extent of man's influence on water quality, and trends in changes in the chemical quality of the river. The study centered on data collected during 1958-77 at the U.S. Geological Survey's stations at Marshall, N.C. The French Broad is a clean river. Only occasionally have concentrations of some trace metals been observed to exceed drinking water standards. However, 58 percent of samples analyzed for fecal coliform bacteria during 1974-77 exceeded criteria levels for bathing waters. Most water-quality variations are associated with variations in streamflow. Concentrations of constituents transported in solution generally decrease at higher flows, whereas concentrations of materials associated with suspended sediment increase with flow. No correlation between discharge and nutrient concentrations has been observed. Man's activities in the basin have resulted in deterioration of water quality. In 1958, an estimated 64 percent of the inorganic dissolved-solids load in the river at

Marshall was due to man-made pollution, and by 1966, it was 74 percent. As of 1977, water quality had returned to levels of 1958, apparently the result of new waste-water treatment facilities and improved industrial technology. (Kosco-USGS)
W80-05445

GEOLOGIC MIGRATION POTENTIALS OF TECHNETIUM-99 AND NEPTUNIUM-237,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5E.
W80-05446

A ONE-DIMENSIONAL, STEADY-STATE, DISSOLVED-OXYGEN MODEL AND WASTE-LOAD ASSIMILATION STUDY FOR SAND CREEK, DECATUR COUNTY, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
W. G. Wilber, C. G. Crawford, and J. G. Peters.
Available from: OFSS Box 25425, Fed. Ctr. Denver, CO., 80225, Paper copy $10.75, microfiche $3.50. Geological Survey open-file report 79-1344, September 1979. 76 p, 31 Fig, 15 Tab, 53 Ref.

Descriptors: *Model studies, *Dissolved oxygen, *Waste assimilative capacity, *Water quality, *Indiana, Streams, Streamflow, Low flows, Reaeration, Effluents, Forecasting, Water quality standards, Water pollution, Waste water disposal, Waste water treatment, Biochemical oxygen demand, Nitrification, Ammonia, Nitrates, Nutrients, Mathematical models, *Decatur County(Ind), *Sand Creek(Ind).

A digital model calibrated to conditions in Sand Creek near Greensburg, Ind., was used to develop alternatives for future waste loadings that would be compatible with Indiana stream water-quality standards defined for two critical hydrologic conditions, summer and winter low flows. The only point-source waste load affecting Sand Creek in the vicinity of Greensburg is the Greensburg wastewater-treatment facility. Non-point, unrecorded waste loads seemed to be significant during three water-quality surveys done by the Indiana State Board of Health. Natural streamflow in Sand Creek during the summer and annual 7-day, 10-year low flow is zero so no benefit from dilution is provided. Effluent ammonia-nitrogen concentrations from the Greensburg wastewater-treatment facility will not meet Indiana water-quality standards during summer and winter low flows. To meet the water-quality standard the wastewater-effluent would be limited to a maximum total ammonia-nitrogen concentration of 2.5 mg/l for summer months (June through August) and 4.0 mg/l for winter months (November through March). Model simulations indicate that benthic-oxygen demand, nitrification, and the dissolved-oxygen concentration of the wastewater effluent are the most significant factors affecting the in-stream dissolved-oxygen concentration during summer low flows. The model predicts that with a benthic-oxygen demand of 1.5 grams per square meter per day at 20C the stream has no additional waste-load assimilative capacity. Present carbonaceous biochemical-oxygen demand loads from the Greensburg wastewater-treatment facility will not result in violations of the in-stream dissolved-oxygen standard (5 mg/l) during winter low flows. (Kosco-USGS)
W80-05451

SELECTED COAL-RELATED GROUNDWATER DATA, WASATCH PLATEAU-BOOK CLIFFS AREA, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
C. T. Sumsion.
Geological Survey open-file report 79-915, 1979. 25 p, 1 Fig, 1 Plate, 7 Tab, 9 Ref.

Descriptors: *Coal mines, *Groundwater, *Hydrologic data, *Utah, *Water quality, Coal mine wastes, Effects, Water supply, Mine drainage, Testing, Water wells, Drillers logs, Water levels, Springs, Discharge(Water), Water analysis, Chemical analysis, *Wasatch Plateau-Book Cliffs area(Utah).

The Wasatch Plateau-Book Cliffs area in east-central Utah consists of about 8,000 square miles within the upper Colorado River drainage system. Coal production in the area is expected to increase from 8 million tons to as much as 30 million tons annually within the next 10 years. Most sources of water supply will be subjected to possible contamination and increased demands by coal-related municipal and industrial growth in the area. The report presents a compilation of coal-related ground-water data from many unpublished sources for the use of local and regional water planners and users. The report includes generalized stratigraphic sections and hydrologic characteristics of rocks in the Wasatch Plateau-Book Cliffs area, records of selected test holes and water wells, logs of selected test holes and water wells, water levels in selected wells, records of selected springs, records of ground-water discharge from selected mines, and chemical analyses of water from selected test holes, water wells, springs, and mines. (Kosco-USGS)
W80-05453

MICROBIOLOGICAL EFFECTS OF RECHARGING THE MAGOTHY AQUIFER, BAY PARK, NEW YORK, WITH TERTIARY-TREATED SEWAGE,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. G. Ehrlich, H. F. H. Ku, J. Vecchioli, and T. A. Ehlke.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.75. Geological Survey Professional Paper 751-E, 1979. 18 p, 7 Fig, 15 Tab, 42 Ref.

Descriptors: *Microbiology, *Artificial recharge, *Aquifers, *Tertiary treatment, *Sewage, New York, Waste water disposal, Injection wells, Well screens, Chlorination, Reclaimed water, Bacteria, Coliforms, Water quality, Path of pollutants, Water chemistry, Trubidity, Water reuse, *Long Island(NY), Well clogging.

Injection of highly treated sewage (reclaimed water) into a sand aquifer on Long Island, N.Y., stimulated microbial growth near the well screen. Chlorination of the injectant to 2.5 milligrams per liter suppressed microbial growth to the extent that it did not contribute significantly to head buildup during injection. In the absence of chlorine, microbial growth caused extensive well clogging in a zone immediately adjacent to the well screen. During a resting period of several days between injection and well redevelopment, the inhibitory effect of chlorine dissipated, and microbial growth ensued. The clogging mat at the well-aquifer interface was loosened during this period, probably as a result of microbial activity. Little microbial activity was noted in the aquifer beyond 20 feet from the well screen; it probably resulted from small amounts of biotransformable substances not completely filtered out of the injectant by the aquifer materials. Movement of bacteria from the injection well into the aquifer was not extensive. In one test, in which injected water had substantial total-coliform, fecal-coliform, and fecal-streptococcal densities, no fecal-coliform or fecal-streptococcal bacteria, and only nominal total-coliform bacteria, were found in water from an observation well 20 feet from the point of injection. (Kosco-USGS)
W80-05455

REDUCTION OF COLIFORM BACTERIA IN TWO UPLAND RESERVOIRS: THE SIGNIFICANCE OF DISTANCE DECAY RELATIONSHIPS,
Leeds Univ. (England). School of Geography.
D. Kay, and A. McDonald.
Water Research, Vol 14, No 4, p 305-318, 1980. 7 Fig, 10 Tab, 42 Ref.

Descriptors: *Bacteria, *Coliforms, *Reservoirs, Land use, Path of pollutants, Pollutants, E. Coli, Water pollution, Water quality, Sampling, Model studies, Mathematical models, Rainfall, Runoff, Watersheds(Basins), Water pollution sources, Agriculture, Agricultural runoff, *England, Bacterial die off, Bacteria density.

This paper reported on the coliform bacterial densities observed between September 1976 and September 1977 in two British upland reservoirs having multiple-use catchment areas. The level of catchment use was defined in terms of agricultural and recreational activity, and the rate of bacterial reduction in the reservoir impoundments was investigated. The applicability of previous studies (which examined rates of coliform reduction in different situations) to the British upland reservoir was discussed, and a set of calculated purification rates, observed during different limnological conditions, were presented. (Sims-ISWS)
W80-05476

ESTIMATES OF ENTRAINMENT IN THE FRASER RIVER PLUME, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W80-05478

USE OF BENTHOS IN LAKE MONITORING,
Swedish Environment Protection Board, Stockholm.
For primary bibliographic entry see Field 2H.
W80-05480

CHEMICAL AVAILABILITY OF MERCURY, LEAD, AND ZINC IN MOBILE BAY SEDIMENT SUSPENSIONS AS AFFECTED BY PH AND OXIDATION-REDUCTION CONDITIONS,
Louisiana State Univ., Baton Rouge. Lab. for Wetland Soils and Sediments.
For primary bibliographic entry see Field 5A.
W80-05486

ADVECTIVE CONTROL OF NUTRIENT DYNAMICS IN THE EPILIMNION OF A LARGE RESERVOIR,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
For primary bibliographic entry see Field 2H.
W80-05491

THE HARMONIZATION OF THE MONITORING OF THE QUALITY OF RIVERS IN THE UNITED KINGDOM,
Department of the Environment, London (England).
For primary bibliographic entry see Field 5A.
W80-05499

SOME POSSIBLE EFFECTS OF ARCTIC INDUSTRIAL DEVELOPMENTS ON THE MARINE ENVIRONMENT,
Institute of Ocean Sciences, Sidney (British Columbia). Frozen Sea Research Group.
For primary bibliographic entry see Field 5C.
W80-05501

HEAVY METAL DISTRIBUTION IN TWO CONNECTICUT WETLANDS: A RED MAPLE SWAMP AND A SPHAGNUM BOG,
Connecticut Univ., Storrs.
J. A. Laundre.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193865, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1980. 56 p, 11 Fig, 1 Tab, OWRT A-073-CONN(2), 14-31-0001-6007.

Descriptors: *Heavy metals, *Distribution patterns, Nutrients, *Water levels, Hydrogen sulfide, Swamps, *Wetlands, Peat, Bogs, Path of pollutants, *Connecticut, Accumulation, Mobilization, Red maple swamp, Spagnum bog.

The vertical distribution of Zn, Cu, Pb, Ni, Mn, K, Na, N, Fe, and Al was studied in a series of peat cores taken from two Connecticut wetlands: a mesotrophic red maple swamp and an oligotrophic Sphagnum bog. In addition, water table fluctuation, sulfide levels, and elemental input from leaf

litter were measured and used in interpreting the distributional patterns of the elements. Within the two wetlands most elements accumulate to some extent in the peat above the water table. Elements below the high water level are subject to some leaching. The red maple swamp does not act as a trap for Pb or Zn. However, Cu, Ni, Mn, Fe, Na, and K enrichment does occur in border areas that are influenced by inflowing spring water. Only Ni is higher in mineral soil-peat contact areas not influenced by springs, indicating possible leaching of Ni from the uplands. Lead does not enter the red maple swamp in seepage or spring water; it apparently only enters through the atmosphere. W80-05514

OPERATIONAL METHODS FOR ANALYSIS OF AGRICULTURAL NONPOINT SOURCE POLLUTION,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W80-05515

ECOLOGICAL STUDIES OF COLONIAL SEABIRDS AT CAPE THOMPSON AND CAPE LISBURNE, ALASKA,
Ecological Research Associates, Fairbanks, AK.
For primary bibliographic entry see Field 5C.
W80-05530

DISTRIBUTION AND DYNAMICS OF HEAVY METALS IN ALASKAN SHELF ENVIRONMENTS SUBJECT TO OIL DEVELOPMENT,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. C. Burrell.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 326-546, October 1979. 56 Fig, 41 Tab. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Heavy metals, *Baseline studies, *Paths of pollutants, Environmental effects, Estuarines, Oil industry, Water pollution effects, Oil pollution, *Outer Continental Shelf, Gulf of Alaska, Bering Sea, Beaufort Sea, Petroleum development.

The baseline work was completed in the Beaufort Sea and in Cook Inlet during the current 1978-79 contract period. The primary objective of this program is to research natural pathways of potentially toxic heavy metals to and through Alaskan shelf and coastal biota (with emphsis on commercially important benthic species) and hence to determine and predict changes likely to result from oil industry activity. Ancillary components include: (1) characterizing the heavy metal inventories of the water, sediment and indigenous biota in those geographical areas for which no background data exist; (2) determining non-biological pathways (rates and routes under both natural and stressed conditions) of the heavy metals as these affect the availability of metals to the organisms; and (3) toxicity effects of selected heavy metals to animals which are of major commercial importance under Alaskan environmental conditions. Apart from some continuing baseline survey work, this program addresses basic problems in heavy metal cycling in estuarine and nearshore areas. The work is an essential prerequisite to an understanding of the changes likely to be induced in the natural system by thorough large scale energy development impingements. (Sinha-OEIS)
W80-05535

THE USE OF POINT DILUTION METHODS IN DETERMINING THE PERMEABILITIES OF LAND-FILL MATERIALS,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 7B.
W80-05554

ANALYSIS, CRITIQUE, AND REEVALUATION OF HIGH-LEVEL WASTE REPOSITORY WATER INTRUSION SCENARIO STUDIES,
Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
For primary bibliographic entry see Field 5E.
W80-05556

BACTERIA: GOOD, BAD AND INDIFFERENT,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5C.
W80-05560

WHAT DO YOU DO ABOUT GAS.
For primary bibliographic entry see Field 5F.
W80-05567

SOURCES,
Hydroscience, Inc., Westwood, NJ.
A. R. Anderson, P. W. Anderson, W. M. Dunstan, L. L. Falk, and J. E. Kerrigan.
In: Proceedings of a Workshop on Assimilative Capacity of U.S. Coastal Waters for Pollutants, Crystal Mountain, Washington, July 29-August 4, 1979, p 8-58, December 1979. 1 Fig, 40 Tab, 107 Ref, Working Paper No 1: Federal Plan for Ocean Pollution Research Development and Monitoring, FY 1981-1985. NOAA, Environmental Research Laboratories, Boulder, Colorado.

Descriptors: *Water pollution sources, *Waste disposal, Baseline studies, Environmental effects, Effluents, Sewage, Industrial wastes, *Outer Continental Shelf, *Ocean dumping, New York Bight, Southern California Bight.

The coastal oceans of the United States have been used for disposal of wastes for many years. The waste mass loading rates have grown as functions of population and production. Materials reach the ocean from many sources: inflow from rivers and ice melt; transfer from the air by fallout, absorption, or precipitation; volcanic activity; and direct released by humans, as treated or untreated sewage, industrial wastes and dredged dumped materials. Estimates of total mass emission rates of a number of parameters to U.S. coastal waters are presented. The data bases used are those developed for the New York Bight and the Southern California Bight. A Qualitative summary of raw liquid effluents from a number of sources is presented and wastes that are now, or could be, disposed of at sea are listed. (Sinha-OEIS)
W80-05568

ESTUARIES,
San Diego State Univ., CA. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2L.
W80-05569

COASTAL AND OPEN OCEAN SCIENCE,
Rhode Island Univ., Kingston. School of Oceanography.
M. Bender, T. Church, D. Edgington, M. G. Gross, and O. Haidvogel.
In: Proceedings of a Workshop on Assimilative Capacity of U.S. Coastal Waters for Pollutants, Crystal Mountain, Washington, July 29-August 4, 1979, p 98-122, December 1979. 5 Fig, 2 Tab, 15 Ref, Working Paper No 1: Federal Plan for Ocean Pollution Research Development and Monitoring, FY 1981-1985. NOAA, Environmental Research Laboratories, Boulder, Colorado.

Descriptors: *Waste disposal, *Coasts, *Water pollution sources, Paths of pollutants, Water pollution effects, Baseline studies, Oceans, Ocean currents, Mixing, *Outer Continental Shelf, *Ocean dumping, Assimilative capacity.

The fate of waste material in the coastal or open ocean, deposited there either directly (by deliberate disposal) or indirectly (by river flows or atmospheric deposition) is considered. The material may be transformed by being dissolved or by forming a new substance. It may be mixed vertically and horizontally in the water by small-scale motion and carried away by larger-scale currents, or it may fall out into the bottom sediments. The waste material may be recycled or accumulated by these processes. It can also be transformed radioactively, chemically or biologically. The scientific problem, then, is a complicated one, involving a variety of physical, chemical, biological, geological, and combined processes, as well as environmental factors. Attacking the problem requires the effective application of much of present knowledge of oceanography in a truly interdisciplinary fashion. The problem falls into two parts: the determination of the concentration distribution in space and time, and the determination of the biological effects. (Sinha-OEIS)
W80-05570

DEEPWATER DUMPSITE 106,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 5C.
W80-05571

THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Atmospheric Labs.
For primary bibliographic entry see Field 5C.
W80-05572

SOUTHERN CALIFORNIA BIGHT,
Southern California Coastal Water Research Project, Long Beach.
For primary bibliographic entry see Field 5C.
W80-05573

PUGET SOUND,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
For primary bibliographic entry see Field 5C.
W80-05574

ENVIRONMENTAL PERMITTING FOR DRILLING IN OFFSHORE AREAS: COMMENTS ON THE SELECTION PROCESS FOR DRILLING FLUIDS,
For primary bibliographic entry see Field 5C.
W80-05577

ENVIRONMENTAL MONITORING ASSOCIATED WITH A PRODUCTION PLATFORM IN THE GULF OF MEXICO,
Continental Shelf Associates, Inc., Tequesta, FL.
D. A. Gettleson, C. E. Laird, R. E. Putt, and R. E. Abbott.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Volume 1, p 263-270, 1980. 13 Fig, 7 Ref, OTC 3706. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Drilling fluids, *Path of pollutants, *Monitoring, *Biota, Environmental effects, Water pollution effects, Currents(Water), Gulf of Mexico, Oil industry, *Outer Continental Shelf, Petroleum development.

The results of a marine environmental monitoring program associated with drilling operations from a production near Baker Bank in the northwestern Gulf of Mexico are described. The study represents the first environmental monitoring program conducted in the Gulf of Mexico for a production platform located near a sensitive biological area. Current direction and velocity data, amounts of sediment and associated barium and chromium levels deposited in sediment traps, bottom sediment barium and chromium levels, and water column data were used to assess the dispersion and distribution characteristics of discharged drilling muds. Television video-tapes and still-camera photographs were used to record the abundance, distribution and health of the biota associated with Baker Bank. The monitoring program showed that the prevailing near-bottom current was to the southwest, away from Baker Bank. Components in

the direction of the Bank were rarely sufficient to transport discharged drilling muds to the Bank. Sediment and water column data also indicated that no drilling muds were transported to the Bank. Camera observations showed no discernable changes in the Bank's biota during the period of the study. (Sinha-OEIS)
W80-05578

HAZARDS ANALYSIS ON THE ATLANTIC OUTER CONTINENTAL SHELF,
G. B. Carpenter, and J. C. McCarthy.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Vol 1, p 419-424, 1980. 4 Fig, 4 Ref. OTC-3728. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Hazards, *Exploration, *Geophysical surveys, *Geology, *Atlantic Ocean, Oil, Gases, Pollution abatement, Environmental effects, Water pollution control, Baseline studies, Water pollution sources, *Outer Continental Shelf, U.S. East Coast, Petroleum development.

Analysis of high-resolution geophysical (HRG) data from the Atlantic Outer Continental Shelf (OCS) indicates that some areas contain geologic and other natural and manmade potential hazards and/or constraints to oil and gas exploration. Results of surveys in the Baltimore Canyon Trough Southeast Georgia Embayment, and Georges Bank show the Atlantic OCS to have fewer near-surface geology-related potential hazards than many other offshore petroleum provinces. However three types of geologic features on the Atlantic OCS are identified that have a relatively high inherent risk (hazards): shallow high-pressure gas, shallow recent faulting (both rare), and submarine slumps and slides which appear to be widespread, particularly on the high (6-7 degree) gradients of the continental slope. Low-rish geologic problems (constraints) are more prevalent and include such common features as buried stream channels, gassy sediments, sand waves and zones of erosion or scour. After these and other related aspects of the local geology have been identified and assessed in terms of potential risk, recommendations are made to the Secretary of the Interior regarding each prospective lease block. In these recommendations blocks are either declared safe in terms of surface geology-related problems, deleted from the sale, or offered for lease with stipulations attached. (Sinha-OEIS)
W80-05581

A SEISMOTECTONIC ANALYSIS OF THE SEISMIC AND VOLCANIC HAZARDS IN THE PRIBILOF ISLANDS-EASTERN ALEUTIAN ISLANDS REGION OF THE BERING SEA,
Lamont-Doherty Geological Observatory, Palisades, NY.
For primary bibliographic entry see Field 6A.
W80-05583

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W80-05584

OFFSHORE PERMAFROST STUDIES AND SHORELINE HISTORY OF CHUKCHI AND BEAUFORT SEAS AS AN AID TO PREDICTING OFFSHORE PERMAFROST CONDITIONS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2C.
W80-05585

MARINE ENVIRONMENTAL PROBLEMS IN THE ICE COVERED BEAUFORT SEA SHELF AND COASTAL REGIONS,
Geological Survey, Menlo Park, CA. Branch of Pacific-Arctic Marine Geology.
For primary bibliographic entry see Field 2C.
W80-05586

YUKON DELTA COASTAL PROCESSES STUDY,
Houston Univ., TX. Dept. of Geology.
For primary bibliographic entry see Field 2C.
W80-05587

EARTHQUAKE ACTIVITY AND GROUND SHAKING IN AND ALONG THE EASTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA. Office of Earthquake Studies.
For primary bibliographic entry see Field 6A.
W80-05588

MECHANICS OF ORIGIN OF PRESSURE RIDGES, SHEAR RIDGES AND HUMMOCK FIELDS IN LANDFAST ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W80-05589

SEISMIC AND VOLCANIC RISK STUDIES - WESTERN GULF OF ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 6A.
W80-05590

SUBSEA PERMAFROST: PROBING, THERMAL REGIME AND DATA ANALYSIS,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W80-05591

BEAUFORT SEACOAST PERMAFROST STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W80-05593

FAULTING, SEDIMENT INSTABILITY, EROSION, AND DEPOSITION HAZARDS OF THE NORTON BASIN SEA FLOOR,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W80-05595

BIOGENIC AND THERMOGENIC GAS IN GAS-CHARGED SEDIMENT OF NORTON SOUND, ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5A.
W80-05596

MODERN BIOGENIC GAS-GENERATED CRATERS (SEAFLOOR 'POCKMARKS') ON BERING SHELF, ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2L.
W80-05597

GEOLOGIC IMPLICATIONS AND POTENTIAL HAZARDS OF SCOUR DEPRESSIONS ON BERING SHELF, ALASKA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W80-05598

SEISMOTECTONIC STUDIES OF NORTHERN AND WESTERN ALASKA,
Alaska Univ., Fairbanks, Geophysical Inst.
For primary bibliographic entry see Field 6A.
W80-05599

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 7B.
W80-05601

OUTER CONTINENTAL SHELF OIL AND GAS BLOWOUTS,
E. P. Danenberger.
Geological Survey Open-File Report 80-101, 1980. 18 p, 1 Fig, 4 Tab.

Descriptors: *Blowouts, *Hazards, *Oil fields, Gases, Oil pollution, Water pollution sources, *Oil industry, *Outer Continental Shelf, Petroleum development, Oil and gas operations.

Blowouts are the most costly and feared operational hazard related to oil and gas operations. During the 8-year period, 1971-1978, 46 blowouts occurred on the Outer Continental Shelf of the United States. Thirty of the blowouts occurred during drilling operations; however, most of these blowouts were of short duration and had minimal effect. The remaining 16 blowouts occurred during completion, production, and workover operations. Blowouts during these nondrilling operations have historically posed the greatest threat to human safety and the environment. During the 8-year study period, 7,553 new wells were started and one blowout occurred for every 250 wells drilled. Oil and condensate production amounted to 2.8 billion barrels with the total blowout spillage less than 1,000 barrels. (Sinha-OEIS)
W80-05604

RUSTY MONSTERS--DISINFECTANT CONTROL OF IRON BACTERIAL INFESTATION,
Regina Water Research Inst. (Saskatchewan).
For primary bibliographic entry see Field 5F.
W80-05614

MANURE SPILLS MAY BE THREAT TO WATER SUPPLIES.
Canadian Water Well, Vol 6, No 2, p 10, May, 1980.

Descriptors: *Farm lagoons, *Water pollution, *Nitrates, Farm wastes, Surface water, Ground water, Fishkill, Public health, Ontario, Runoff, Water pollution sources.

Runoff from liquid manure holding ponds has caused significant surface water pollution and threatens ground water supplies in southwestern Ontario. High nitrate levels in drinking water can cause methemoglobanemia in infants up to several months of age. Scientists at the University of Guelph and the University of Waterloo have been studying nitrate levels in groundwater surrounding an earthen liquid manure pond. The preliminary conclusion from this study is that the effect of the ponds on ground water quality is minimal. However, excessive runoff may cause the pond to overflow. (Purdin-NWWA)
W80-05624

THE ROLE OF MACROBENTHIC ORGANISMS IN MERCURY, CADMIUM, COPPER AND ZINC TRANSFERS IN GEORGIA SALT MARSH ECOSYSTEMS,
Emory Univ., Atlanta, GA.
D. R. Kendall.
Ph.D. Dissertation, 1978. 254 p.

Descriptors: *Distribution patterns, *Metals, *Benthic fauna, *Georgia, *Salt marshes, Bioassay, Wetlands, Seasonal distribution, Marshes, Water pollution, Invertebrates, Benthos, Aquatic animals.

Seasonal dynamics of Hg, Cd, Cu, and Zn in two salt marsh estuaries showed a net buildup of organic matter in sediments commencing during spring, concomitant with net decreases in leachable Cu and Zn during the same periods. Leachable Cd and Hg were correspondingly highest during spring, although demonstrable changes in water levels were relatively slight between summer and winter in both estuaries. Leachable metal levels were generally low in subtidal sediments of both estuaries compared with corresponding levels in macrobenthic invertebrates. Intraspecific macrobenthic invertebrate metal burdens were highly correlated within body size for the most part, and independent of seasons, sediment levels, and spatial differences within and between estuaries. Interspecific

metal burdens were independent of trophic relationships in macrobenthic invertebrate species. The distribution of Hg in macrobenthic species appeared to be partially related to body size, as smaller species generally exhibited higher Hg burdens than larger species, which was not the case with Cd, Cu and Zn. Annual subtidal macrobenthic metal budgets for both estuaries were relatively insignificant compared to net amount sediment accumulations of metals and total riverine inputs, suggesting this community plays a relatively insignificant role in the estuarine biogeochemical cycle of these metals. (Steiner-Mass)
W80-05631

MIGRATORY PROPERTIES OF SOME NUCLEAR WASTE ELEMENTS IN GEOLOGIC MEDIA,
Argonne National Lab., IL.
For primary bibliographic entry see Field 5E.
W80-05661

THE TRANSLOCATION OF LEAD AND COPPER IN TWO SUBMERGED AQUATIC ANGIOSPERM SPECIES,
Westfield Coll., London (England).
R. Peter, H. Welsh, and P. Denny.
Journal of Experimental Botany, Vol 30, No 115, p 339-345, April, 1979. 2 Fig, 21 Ref.

Descriptors: *Submerged plants, *Metals, *Translocation, Aquatic plants, Copper, Lead, Pondweeds, Water pollution.

The translocation of lead and copper was studied in two species of submerged aquatic angiosperm, Potamogeton crispus L. and Potamogeton pectinatus L. A perspex container incorporating a potters' clay seal around the stems of intact plants was designed for the chemical separation of the shoot and root environments during 11-21 d treatment periods. Metal solutions were added to the root or shoot environments and concentrations were monitored in waters and sediments. A technique was developed for the direct quantitative analysis of metals in small (0.02-0.2 mg) segments of water plant tissue, using the graphite rod attachment to an atomic absorption spectrophotometer. Experimental results indicated minimal translocation of lead, but extensive acropetal translocation of copper to particular sites of accumulation. (Steiner-Mass)
W80-05678

HERBICIDE CONTAMINATION AND DECONTAMINATION OF WELL WATERS IN ONTARIO, CANADA 1969-78,
Guelph Univ. (Ontario); and Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
R. Frank, G. J. Sirons, and B. D. Ripley.
Pesticides Monitoring Journal, Vol 13, No 3, p 120-127, December, 1979. 1 Fig, 6 Tab, 11 Ref.

Descriptors: *Herbicides, *Water pollution, *Water pollution treatment, *Water wells, Canada, Sampling, Water analysis, Water pollution sources.

Between 1969 and 1978, 237 wells in Ontario suspected of contamination were sampled. No identifiable contaminant could be found in 78 wells. In 98 wells, a single herbicide was detected, in 46, two herbicides were found; in 12, three herbicides were found; one had four and another had five herbicides. Twenty-two herbicides were identified with levels of contamination ranging from 0.01 micrograms/liter to 150 mg/liter. The most frequent causes of contamination were aerial spray drift or runoff. However, serious contaminations were caused by direct spills of concentrated herbicide into the well and spraying solution around the well. Subterranean movement of herbicides into wells resulted in persistent low-level contamination. Case studies of the decontamination of 24 wells are presented in tabular form. In some cases, the wells were emptied and the contaminated soil was removed. Hence decontamination was rapid (61-100 days). Where only water was removed, decontamination took 20-1093 days. A few wells had to be abandoned. Amitrole, dinoseb, and picloram were particularly difficult to remove, but alachlor, atrazine, and 2-4-D were removed more rapidly. (Purdin-NWWA)
W80-05679

5C. Effects Of Pollution

HYPOLIMNION INJECTION OF NUTRIENT EFFLUENTS AS A METHOD FOR REDUCING EUTROPHICATION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 2H.
W80-05422

THE ECOLOGY OF AEROMONAS HYDROPHILA IN ALBEMARLE SOUND, NORTH CAROLINA,
Wake Forest Univ., Winston-Salem. Dept. of Biology.
G. W. Esch, and T. C. Hazen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-216682, Price codes: A07 in paper copy, A01 in microfiche. UNC-WRRI Report No 153, Water Resources Research Institute of The University of North Carolina, Raleigh, Jan 1980. 116 p, 143 Fig, 7 Tab. OWRT B-112-NC(1), 14-34-0001-8106.

Descriptors: *Ecology, *Fish, Eutrophication, Nutrients, Phosphorus, Aeromonas hydrophila, *Fish diseases, Chlorophyl a, Stress, *Coliforms, *Red-sore disease, *Albemarle Sound(NC), North Carolina, Chowan River(NC).

In an attempt to identify parameters involved with outbreaks of fish red-sore disease in Albemarle Sound, N. C., densities of Aeromonas hydrophila, fecal and total coliforms were measured in conjunction with 18 physical and chemical parameters at 29 stations. Strong correlations between A. hydrophila densities and phosphorus and phosphates were found. Data indicated that 87% of the water samples had total phosphorus concentrations suggesting eutrophic conditions. In July 1979 densities of A. hydrophila exceeded 1,000 cfu ml, corresponding with a massive outbreak of red-sore disease in commercial and game fish. Evidence indicates that stress plays a major role in the disease. The authors propose a combination of factors are responsible in Albemarle Sound, including various forms of nitrogen, phosphate, total phosphorus and total organic carbon which create conditions conducive to abundance of A. hydrophila. Thus, the combination of excessive nutrient loading, increased density of A. hydrophila and host stress would lead to outbreaks of red-sore disease and fish mortality.
W80-05464

SUBLETHAL EFFECTS OF POLLUTANTS: TEST OF THE USEFULNESS OF LIFE TABLES FOR EVALUATING THE IMPACT OF CHRONIC TOXICITY,
Maryland Univ., College Park. Dept. of Zoology.
J. D. Allan, and R. E. Daniels.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-216674, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of Maryland, Technical Report No 57, February 1980. 60 p, 14 Fig, 5 Tab, 35 Ref. OWRT A-045-MD(1), 14-34-0001-8022.

Descriptors: *Pollutants, *Ecology, Life tables, *Pesticides, Sublethal effects, *Toxicity, Eurytemora affinis, Daphnia, Aquatic environment, Ecosystems.

The estuarine copepod Eurytemora affinis and the fresh water daphniid Daphnia pulex were used to test the usefulness of the intrinsic rate of population increase, r, as a chronic bioassay statistic. The toxicant used was dieldrin, a highly persistent organochlorine pesticide. Three hypotheses were tested: (1) the intrinsic rate of population increase is not affected until the 48 hour acute lethal concentration (LC50) is reached; (2) r decreases proportionately with increasing dieldrin concentration and (3) ris affected well below the LC50 value. For E. affinis r declined precipitously at 5ppb, which is 20% of the experimentally determined LC50 of 23ppb. This decline is attributable to increased time to reproductive maturity, increased time between broods and increased mortality of pre- and post-reproductive females. This decline is representative of Hypothesis 3. For D. pulex r declined at 200ppb, which is 80% of the experimentally determined concentration where 50% of the animals were effectively damaged (EC50) of 251ppb. This decline in r is attributable solely to increased mortality in reproductive females and is representative of Hypothesis 1. It is concluded that r is a better predictor of the sensitivity of E. affinis to dieldrin than the LC50, while r and the EC50 are approximately equal in predicting D. pulex and E. affinis suggests that E. affinis and copepods in general may be more suitable chronic bioassay organisms than D. pulex.
W80-05465

MORPHOLOGY AND HAZARDS RELATED TO NEARSHORE ICE IN COASTAL AREAS,
Alaska Univ., Fairbanks. Geophysical Inst.
W. J. Stringer.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 1, p 1-22, 1979. 6 Fig. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Sea ice, *Hazards, *Coasts, Ice morphology, Oil spills, Alaska, Baseline studies, Exploration, Drilling, *Outer Continental Shelf, Petroleum development, Ice conditions.

The objective of this study was to develop a general morphology of nearshore ice along the Beaufort, Chukchi and Bering coasts of Alaska, and identify those features which may represent hazards imposed by ice conditions on outer continental shelf oil and gas development. Landsat imagery has been utilized to map major winter and spring Beaufort, Chukchi, and Bering Sea nearshore ice conditions for 1973-1977 related to regional ice morphology. Following this, significant features from individual Landsat image maps have been combined to yield regional maps of major ice ridge systems for each year of study and maps of flaw lead systems for representative seasons during each year of study. These regional maps have, in turn, been used to prepare seasonal ice morphology maps. The seasonal ice morphology maps show, in terms of a zonal analysis, regions of statistically uniform ice behavior. The behavioral characteristics of each zone have been described in terms of coastal processes and bathymetric configuration. Based on the combined seasonal morphologies, a zonal analysis of potential hazards related to offshore petroleum development has been made for the study area. The general conclusion is that overall nearshore sea ice behavioral patterns are sufficiently similar from year to year, that 5 years' data can yield some predictability in terms of offshore sea ice hazards to oil and gas development. The implications are that geographical zones of different design and construction criteria can be established in the offshore areas based on the probability of damage to the structure by adverse ice conditions and the relative risk imposed to the adjacent ecosystems. (Sinha-OEIS)
W80-05500

SOME POSSIBLE EFFECTS OF ARCTIC INDUSTRIAL DEVELOPMENTS ON THE MARINE ENVIRONMENT,
Institute of Ocean Sciences, Sidney (British Columbia). Frozen Sea Research Group.
E. L. Lewis.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 1, p 369-392, 1979. 5 Fig, 4 Tab, 37 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Oil spills, *Hazards, *Arctic, Sea ice, Drilling, Transportation, Baseline studies, Water

pollution sources, Resources development, Environmental effects, Oil industry, *Outer Continental Shelf, Petroleum development, Canadian Arctic, Environmental impact.

Marine environmental disturbances associated with the exploratory, production, and transportation phases of the exploitation of the arctic by primary industry are discussed. Some essential prerequisites for these developments are to possess sufficient knowledge to identify potential conflicts in usage of an area, and to know ocean currents, ice movements, etc. sufficiently to predict effluent transport. Probable physical changes to the environment to be expected from routine operations and those that may result from disasters are outlined. By far the greatest threat to the environment from exploratory drilling would be from a 'blowout' of oil and gas from the sea bed due to a sudden uncontrolled pressure increase as the drill bit penetrated oil/gas bearing sediments. Another possible source of environmental contamination under exploratory circumstances would be oil or fuel spilled because of serious damage to the drillship or supporting vessels. Quantities of oil spilled are likely to be far greater during the production and transportation phases of development. (Sinha-OEIS)
W80-05501

OIL POLLUTION IN ICE-COVERED ARCTIC WATERS,
Alaska Univ., Fairbanks. Geophysical Inst.
G. Weller.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 1, p 393-406, 1979. 1 Fig, 9 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Sea ice, *Ice cover, *Hazards, *Oil pollution, Water pollution effects, Environmental effects, Biota, Aquatic life, Baseline studies, Resources development, *Outer Continental Shelf, Environmental assessment, Beaufort Sea, Petroleum development.

The problems of oil pollution in ice-covered arctic seas are discussed, based on the experiences and studies in the Beaufort Sea made by the United States' Outer Continental Shelf Environmental Assessment Program and by the Canadian Beaufort Sea Project. Problems of offshore petroleum operations in the Beaufort Sea are described in terms of sea ice hazards, subsea permafrost, ice gouging and climatic extremes, and the risks they pose, particularly in causing possible accidental oil spills. These risks are very high. The probability of blowouts and other oil-spilling accidents in ice-covered waters are discussed and the likely transport pathways and behavior of oil spilled in and under the sea ice are reviewed. The effects of the spilled oil on the biota and the environment vary with the location and the time of the year when the spill occurs, but are largely speculative and difficult to quantify at present. (Sinha-OEIS)
W80-05502

SOME RELATIONSHIPS BETWEEN ENVIRONMENTAL ASSESSMENTS AND ARCTIC MARINE DEVELOPMENT,
Alaska Univ., Fairbanks.
D. W. Norton.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 1, p 407-421, 1979. 2 Fig, 15 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Environmental effects, *Resources development, *Cost-benefit analysis, Arctic, Water pollution effects, Baseline studies, Oil industry, Leases, Ecology, *Outer Continental Shelf, Environmental assessment, Beaufort Sea, Petroleum development.

The U.S. National Environmental Policy Act of 1970 requires consideration in public of the environmental effects ('impacts') of any major federal project in advance. Alaskan North Slope, coastal and nearshore environmental analyses of the Beaufort Sea, in advance of a proposed oil and gas lease sale there, provide case studies of how ecological understanding can affect technology and the course of arctic marine development. These arctic analyses are part of a larger U.S. Outer Continental Shelf Environmental Assessment Program. Some critics may view such environmental studies as more nuisance than substance, and an obsolete irrelevance rooted in a temporary public preoccupation with the environment in the late 1960's. But, since virtually any activity costs more in the Arctic than at lower latitudes, it is especially important to keep in mind the cost-to-benefit ratios throughout an entire project, such as resource extraction (including required environmental analyses). (Sinha-OEIS)
W80-05503

ASSESSING IMPACTS OF PETROLEUM DEVELOPMENT ON ALASKA'S CONTINENTAL SHELF -- A NEW APPROACH,
LGL Ecological Research Associates, Bryan, TX.
J. C. Truett.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 1, p 423-434, 1979. 3 Fig, 6 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Environmental effects, *Resources development, *Methodology, Ecology, Water pollution effects, Baseline studies, Alaska, *Outer Continental Shelf, Petroleum development, Ecological processes, Beaufort Sea.

Early in 1976 a unique environmental research program commenced in a barrier island-lagoon system on Alaska's Beaufort Sea Coast to evaluate the impact of proposed petroleum developments. The program was designed to test an approach to impact assessment that would offer more relevant and cost-effective estimates of environmental impacts than were possible with conventional strategies. The research emphasized investigations of ecological and physical processes rather than calling for extensive inventories of components of the environment. It concentrated on studying processes that supported components identified to be of special interest to society. The analysis of processes in this study has proved superior to conventional strategies of environmental studies because (1) it required the focusing of research on environmental issues of greatest interest to the public and their representatives in government, thereby eliminating research activity extraneous to the needs of impact assessment, (2) it addressed environmental processes rather than components alone, so that interactions between the components and man's activities could more easily be predicted, and (3) it created a logical structure for coordinating the research of several scientific disciplines. (Sinha-OEIS)
W80-05504

ENVIRONMENTAL HAZARDS ON THE UNITED STATES CONTINENTAL SHELF,
Geological Survey, Reston, VA.
P. G. Teleki, M. A. Hampton, and L. E. Garrison.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 1, p 435-448, 1979. 1 Fig, 1 Tab, 62 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Hazards, *Sediments, *Offshore platforms, *Soil properties, Sediment transport, Resources development, Drilling, Baseline studies, Gases, Environmental effects, Oil industry, *Outer Continental Shelf, Petroleum development, Ice forces, Environmental assessment.

Accelerated exploration for petroleum resources in frontier areas of the United States Continental Shelf and procedures for verifying the adequacy of the design of offshore structures have placed renewed emphasis on the evaluation of offshore environmental hazards. The U.S. Geological Survey (USGS) has begun such an evaluation in support of offshore engineering activities, grouping the hazards into three categories: (1) geologic/geotechnical, (2) seismic, and (3) oceanographic/meteorologic. The preliminary evaluation indicates that storm-generated wave and wind forces will be the primary problem for platforms planned for offshore New England and the MidAtlantic States. Currents and sediment transport may be significant environmental problems in these areas. Strong earthquake ground motion can affect all petroleum development areas along the Pacific Coast of the U.S., and strong motion combined with high wind and sea states will govern structural design criteria for the Gulf of Alaska. Ice forces derived from the motion and the mechanical properties of floating sea ice are the first concern in drilling, production and transportation operations in the potential lease areas of the northern Bering, Chukchi, and Beaufort Seas. Because of limited knowledge about them, the engineering properties of ice-bonded sediments and those containing clathrates need further evaluation. Most offshore areas still need to be studied in detail for the occurrence, areal extent, and mobility of slumping and sliding sediments. Investigations show that soil stability can be dependent on wave conditions (the Mississippi Delta), earthquake shaking (the Gulf of Alaska), and gas in sediments (Norton Sound, Alaska). (Sinha-OEIS)
W80-05505

FAST ICE THICKNESS AND SNOW DEPTH RELATIONSHIPS RELATED TO OIL ENTRAPMENT POTENTIAL, PRUDHOE BAY, ALASKA,
P. W. Barnes, E. Reimnitz, L. J. Toimil, and H. R. Hill.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 2, p 1205-1225, 1979. 11 Fig, 2 Tab, 14 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Hazards, *Sea ice, *Ice cover, *Oil pollution, *Morphology, Path of pollutants, Environmental effects, Resources development, Gases, Alaska, Baseline studies, *Outer Continental Shelf, *Fast ice, Oil entrapment, Prudhoe Bay, Petroleum development, Prudhoe Bay(AK).

The undersurface of sea ice (ice bottom) on arctic shelves acts upon the sea bed directly by contact and indirectly by influencing hydrology, and serves as a trap for pollutants released from the sea bed. Investigations in early May, 1978, studied the relationship between ice bottom morphology, sea bed morphology, tidal currents, and variations in snow thickness at three sites representing three different fast-ice environments--protected bay, deep open lagoon, and narrow tidal channel. Trenches were cut through the ice parallel and perpendicular to the sastrugi-sculptured northeast-southwest trending snow ridge pattern. Along the trench transects snow depth, ice thickness, and ice draft were measured and an upward-directed side-scanning sonar was towed to examine the morphology of the ice bottom in an area 100 m square. Snow depth and ice thickness vary 30-40 cm along the trench transects and exhibit a negative correlation--thin ice coinciding with a thicker insulating snow cover. The three-dimensional snow and ice morphology patterns reinforced the transect correlation. Elongate ridge and trough patterns on the ice bottom parallel the surface snow ridge patterns. The results imply a seasonal stability for the snow ridge pattern and that sub-ice oil concentrations would be indicated by surficial snow morphology in the fast ice zone. Sub-ice oil would spread parallel to the troughs most readily, and therefore upwind and downwind. In spring, gases will leak to the surface. (Sinha-OEIS)
W80-05506

THE REGULATORY ASPECTS OF OFFSHORE PETROLEUM ACTIVITY IN THE ALASKA BEAUFORT SEA - AN INDUSTRY VIEWPOINT,

R. C. Herrera.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 1, p 449-465, 1979. 1 Fig, 6 Ref, Append. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Resources development, *Oil industry, *Regulation, *Environmental effects, Social aspects, Economics, Whales, Water pollution effects, Permits, Leases, Alaska, *Outer Continental Shelf, Petroleum development, Alaska North Slope, Beaufort Sea.

A brief history is given of oil and gas exploration and development on the North Slope of Alaska with particular reference to the 14 exploratory wells drilled from artificial or natural islands in the Beaufort Sea. The oil and gas potential of the proposed Beaufort Sea sale area is discussed and an assessment is made of its importance to the overall energy supply position of the U.S. and the future fiscal needs of the State of Alaska. A factual account of the permitting and regulatory procedures which are required to drill an offshore well is outlined, and is amplified in an Appendix by a case history of a specific well, Niakuk No. 3. The impact of future Beaufort Sea oil and gas development is investigated with specific reference to the North Slope Inupiat community and the social and cultural changes it is undergoing. Connected with this are the problems imposed by the presence in the area of the bowhead whale, which is an endangered species, and which has great importance in the subsistence life style of the Inupiat. The reactions of the regulatory authorities and the oil industry to the perceived impacts are described. The industry has approached the problem by initiating a great deal of biological, technological and environmental research to increase the safety of drilling operations and has instituted a major communication effort. The effects of excessive regulations are investigated and it is concluded that the major benefits of current and pending regulations will result from the dialogue they cause among the governments, industry, the Inupiat and the environmentalists. However, the regulations themselves will not achieve the two goals of affordable oil and an unharmed environment. (Sinha-OEIS)
W80-05507

OIL SPILL ON THE SHORE OF AN ICE-COVERED FJORD IN SPITSBERGEN,
Norges Vassdrags- og Elektritets- vesen, Oslo.
T. Carstens, and E. Sendstad.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 2, p 1227-1242, 1979. 6 Fig, 2 Tab, 21 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Ice, *Oil spills, *Path of pollutants, *Trapping, Ecosystem, Environmental effects, Water pollution effects, Aquatic life, Fjords, Degradation(Decomposition), Norway, *Outer Continental Shelf, Transport routes, Ecological impact, Spitzbergen(Norway).

A slow leak between 20 April and 16 May 1978 from a tank on the shore at Svea, van Mijenfjorden, deposited 130 cu m of diesel fuel in the fjord. The spill was invisible until the snowmelt runoff transported oil onto the 1.5 m thick ice, beginning 23 May. In early June snow, ice, water and soil samples were collected and currents were observed under the ice. After breakup in July shore sediment and biological samples were taken throughout the fjord. Inferences are drawn from the observations regarding transport routes and degradation of the oil and of the ecological impact of the spill. The conclusions are that most of the oil was trapped by the ice and transportted out of the fjord during breakup. The shore fauna in the immediate vicinity of the tank was wiped out, but the impact on the fjord ecosystem seemed otherwise negligible. (Sinha-OEIS)
W80-05508

ASSESSMENT OF SAR FOR OIL POLLUTION SURVEILLANCE IN THE ICE ENVIRONMENT,
REMOTEC Applications Inc., St. John's (Newfoundland).
For primary bibliographic entry see Field 5A.
W80-05509

THE EASTERN ARCTIC MARINE ENVIRONMENTAL STUDY PROGRAM,
Department of Indian Affairs and Northern Development, Ottawa (Ontario).
O. H. Loken.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 3, p 139-152, 1979. 1 Fig, 1 Tab, 51 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Environmental effects, *Water pollution effects, *Oil pollution, *Exploration, Drilling, Resources development, Baseline studies, Arctic, *Outer Continental Shelf, Canadian Eastern Arctic, Baffin Bay, Davis Strait, Environmental assessment, Petroleum development.

A comprehensive environmental assessment was required before the Department of Indian Affairs and Northern Development would permit offshore exploratory drilling in the Canadian Eastern Arctic. The Eastern Arctic Marine Environmental Studies (EAMES) Program was initiated to obtain the data base for this review. In planning the studies an uncontrolled blowout with oil emerging at the sea floor was considered as the 'worse-case scenario' and the studies were aimed at determining what biological resources are where, at what time, and how they can be protected. This requires a knowledge of a broad range of factors: oceanographic and meteorological parameters, the behaviour of oil injected into the water column at great depth, distribution of marine mammals, sea birds, plankton, ice, etc. at different times. The Program is coordinated through a joint Government-Industry-Native people management committee with most studies being carried out by industry and their consultants. Due to the size of the area three environmental impact statements will be prepared; one for Davis Strait has already been reviewed and the area environmentally cleared for exploratory drilling. The list of reports submitted for the environmental review indicates the scope of the studies and thoroughness of the review. An EAMES Advisory Board consisting of representatives from the Inuit communities and four university professors was established to provide a communication link between industry and government and to give independent scientific advice on the effectiveness and efficiency of individual projects. (Sinha-OEIS)
W80-05510

SPILLED OIL RETENTION POTENTIAL - BEAUFORT SEA COAST OF ALASKA,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
D. Nummedal, and C. H. Ruby.
In: POAC 79, Proceedings 5th International Conference on Port and Ocean Engineering Under Arctic Conditions, held at The Norwegian Institute of Technology, August 13-18, 1979, Vol 3, p 247-253, 1979. 2 Fig, 1 Tab, 6 Ref. The University of Trondheim, The Norwegian Institute of Technology, Trondheim, Norway.

Descriptors: *Oil spills, *Environmental effects, *Morphology, Sediments, Vegetation, Coasts, Resources development, Water pollution effects, Alaska, *Outer Continental Shelf, *Beaufort Sea, Habitat sensitivity, Retention index, Petroleum development.

Based on aerial photography and field sampling, the Beaufort Sea coast of Alaska has been classified with respect to its oil spill retention potential. A retention index, which is a measure of the ability of an environment to retain the oil once introduced, is developed. The index value for a given shoreline type is determined by the energy levels of the natural processes which tend to remove the oil, the texture of the sediments, and the morphology and vegetation at the site. Empirical evidence from past oil spills were used to evaluate the effects of these factors. The oil spill retention potential of the entire Beaufort coast from Pt. Barrow to Demarcation Pt. has been mapped at a scale of 1:50,000. Two reduced and slightly generalized sample maps are included in the paper. It is concluded that there is a close relation between the morphological and sedimentary characteristics of an environment and the biological concept of habitat sensitivity. (Sinha-OEIS)
W80-05511

OIL IN MOVING PACK ICE - LABORATORY STUDY,
For primary bibliographic entry see Field 5A.
W80-05512

STUDY OF CLIMATIC EFFECTS ON FAST ICE EXTENT AND ITS SEASONAL DECAY ALONG THE BEAUFORT-CHUKCHI COASTS,
Colorado Univ. at Boulder. Inst. of Arctic and Alpine Research.
R. G. Barry.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 2: Physical Science Studies, p 272-375, December 1979. 14 Fig, 5 Tab, 24 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Sea ice, *Seasonal variations, *Climatology, *Hazards, Polar regions, Alaska, Baseline studies, Water pollution effects, Resources development, Paths of pollutants, Oil spills, *Outer Continental Shelf, *Fast ice, Beaufort Sea, Chukchi Sea, Petroleum development.

The most significant hazard to offshore petroleum development along the Beaufort-Chukchi Sea coasts of Alaska is posed by the occurrence of sea ice for at least nine months of the year. Offshore petroleum development may involve temporary operations on the winter fast-ice surface or in the open water during summer. Alternately, large, ice-resistent structures may be used year-round. An accurate assessment of the best operational modes and of the seasonal distribution of ice hazards requires that the normal patterns of fast-ice characteristics and breakup processes and their interannual variability be specified. Also, the pathways of pollutants deriving from oil spills or blowouts are dependent to some degree on the season, and, in summer, on the relative progression of the breakup. Some of the major findings are: (1) the rate and pattern of summer breakup of the fast ice in the Beaufort Sea is strongly influenced by the history of ice events during the preceding winter; (2) the stages of fast ice decay and northward pack ice retreat on the Beaufort Sea coast can be correlated with the accumulated thawing-degree days (TDDs); (3) in order of importance, air temperature, sea-level pressure distribution, and surface wind direction account for most of the year-to-year variance in northward pack ice retreat; and (4) monthly temperatures at Barrow in summer show some persistence that may be applied to forecasting breakup conditions. (Sinha-OEIS)
W80-05518

A SURVEY OF CETACEANS OF PRINCE WILLIAM SOUND AND ADJACENT VICINITY - THEIR NUMBERS AND SEASONAL MOVEMENTS,
Fish and Wildlife Service, Sacramento, CA. Office of Biological Services.
J. D. Hall.
In: Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators. Volume 6: Biological Studies, p 631-726, December 1979. 6 Fig, 3 Tab, 17 Ref, 3 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Mammals, *Food chains, *Oil pollution, *Water pollution effects, Baseline studies, Alaska, Environmental effects, Resources develop-

ment, *Outer Continental Shelf, Cetaceans, Prince William Sound, Petroleum development, Petroleum transport.

Basic objectives of this project were to document the relative numbers and seasonal distribution of cetaceans in Prince William Sound, Alaska and to determine major foraging and accumulation areas for principal species. With regard to peak numbers, Odontocete (Toothed) cetaceans are far more numerous in Prince William Sound than are Mysticete cetaceans. Mysticete whales probably do not number over 100 animals during the peak of the summer season, but many more pass through the area on migrations to or from feeding grounds in the Bering Sea. It is estimated that almost the entire population of gray whales passes through the Northeast Gulf of Alaska twice yearly. It is presumed that oil and gas development impact on cetaceans will arise from two sources. The first will be disturbance due to human activity associated with exploration and development, and is expected to be minor since significant vessel activity occurs in the study area at present. The second potential impact on cetaceans will be caused by oil spills. Either a spill from a drilling rig in the Northeast Gulf of Alaska or a spill by a loaded tanker outside Prince William Sound could impact cetaceans. Direct impact would include oiling of the animals themselves, while secondary impact would affect the food chain upon which the whales are dependent. (Sinha-OEIS)
W80-05519

MORBIDITY AND MORTALITY OF MARINE MAMMALS,
Alaska Univ., Fairbanks.
F. H. Fay, R. A. Dieterich, L. M. Shults, N. K. Murray, and A. Hoover.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 1-34, October 1979. 1 Fig, 7 Tab, 10 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-56.

Descriptors: *Mammals, *Morbidity, *Mortality, *Oil pollution, Pathology, Water resources, Baseline studies, Environmental effects, Resources development, Alaska, Water pollution effects, *Outer Continental Shelf, Petroleum development, Ecological distribution, Cetacea, Pinnipedia.

This is an investigation of the kinds, rates of occurrence, and causes of pathological conditions in the living populations of marine mammals on the Alaskan continental shelf, through necropsy of specimens collected principally for use in other OCSEAP projects. Coupled with this is an investigation of the kinds, numbers, distribution, and causes of death of marine mammal carcasses that wash ashore along the Alaskan coast. The goal of this study is to determine the normal, pre-OCS-petroleum-development pattern of illness and death from natural causes in those populations. Emphasis is placed on identification of debilitating and mortality factors whose effects might be enhanced synergistically by the stresses brought to bear in connection with exploration and development of offshore petroleum resources. Since marine mammals are the top level consumers in the marine ecosystem, wholly dependent on the productivity of all trophic levels below them, their health is one of the best, most visible indicators of the 'health' of the system itself. Their responses to short-term changes are also readily detectable from their physical condition, reproductive success, and mortality rates. Since the frequency of occurrence and effects of pathogens are likely to be enhanced in animals stressed by other factors, monitoring the relative health of these animals can provide nice indications of the functional state of the system in which they live. (Sinha-OEIS)
W80-05520

TROPHIC RELATIONSHIPS AMONG ICE INHABITING PHOCID SEALS,
Alaska Dept. of Fish and Game, Fairbanks.
L. F. Lowry, K. J. Frost, and J. J. Burns.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 35-109, October 1979. 3 Fig, 29 Tab, 67 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-53.

Descriptors: *Mammals, *Ecosystems, *Whales, *Seals, *Ice, Water pollution effects, Baseline studies, Environmental effects, Resources development, Trophic level, Alaska, *Outer Continental Shelf, *Ecosystems, Petroleum development, Pinnipedia, Odontoceti, Bering Sea, Chukchi Sea.

Ice-inhabiting seals are highly visible, numerous, sociologically and economically important species in the Bering-Chukchi, and Beaufort marine ecosystems. A complete understanding of the role of these seals in the trophic structure of these ecosystems is crucial to the evaluation of potential impacts of OCS development. By understanding the trophic relationships among ice-inhabiting seals and other consumers in the system, indirect effects of OCS development (e.g. those favoring population increase of potential food resource competitors) can be predicted. Preliminary information is presented on the foods of belukha whales in the Bering and Chukchi Seas. This information will be included in the assessment of possible effects of OCS development on trophic relationships of ice-associated marine mammals. A total of 1,585 specimens are included in this report, more than twice the number reported on in 1978. The majority of the samples were collected at coastal hunting sites in the Bering and Chukchi Seas during summer. Results are presented by locality and time of year for three major geographical areas: southeastern Bering Sea, northern Bering Sea and Chukchi Sea. (Sinha-OEIS)
W80-05521

POPULATION ASSESSMENT, ECOLOGY AND TROPHIC RELATIONSHIPS OF STELLER SEA LIONS IN THE GULF OF ALASKA,
Alaska Dept. of Fish and Game, Anchorage.
D. Calkins, K. Pitcher, K. Schneider, D. McAllister, and W. Cunningham.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 144-168, October 1979. 5 Fig, 9 Tab. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-69.

Descriptors: *Mammals, *Oil pollution, *Water pollution effects, Baseline studies, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Gulf of Alaska, Petroleum development, *Sea lions.

This project is a detailed study of the population dynamics, life history and some aspects of the ecology of the Steller sea lion (Eumetopias jubatus). The basic objectives of the sea lion work are to provide information on population status, seasonal distribution, movement patterns, population composition and segregation, use of critical habitats, food habits, reproductive biology and productivity. The study was carefully designed to examine the potential impacts associated with exploration for, development of and transporatation of crude oil and natural gas reserves in the Gulf of Alaska. All three species of marine mammals studied under this project are vulnerable to Outer Continental Shelf oil and gas development through direct contact and contamination, indirect contamination of food sources or habitat, and disturbance generated by activities associated with exploring for and recovering oil and gas. (Sinha-OEIS)
W80-05522

SIMULATION MODELING OF MARINE BIRD POPULATION ENERGETICS, FOOD CONSUMPTION, AND SENSITIVITY TO PERTURBATION,
New Mexico Univ., Albuquerque.
J. A. Wiens, G. Ford, D. Heinemann, and C. Fieber.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 217-270, October 1979. 32 Fig, 1 Chart, 19 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Birds, *Oil pollution, *Water pollution effects, *Environmental effects, Ecosystems, Models, Resources development, Alaska, *Outer Continental Shelf, Petroleum development, Pribilof Islands(AK), Common murres, Red-legged Kittiwakes.

In the development of models to explore the effects of oil perturbations on breeding seabird colonies, as depicted by the Pribilof Islands' colonies, major attention was given to short-term (within-year) and to long-term (multi-year) effects. This report describes the model structures, analyses, and results for each level of modeling, and discusses the relevance of these exercises for oil-related impacts on colonially-breeding marine birds. Analysis shows that the chronic effects of oil development may be much more damaging than the short-term effects of an oil spill because of the extreme sensitivity of these populations to slight changes in annual survival (especially of adults) and in fecundity. In general, the populations should be able to recover from oil spills, although in some cases it may take decades, but a permanent decrease in annual survival or fecundity may push a species over the edge, making it unable to persist on the Pribilofs. This argument is especially germaine to Red-legged Kittiwakes, since over 95% of the world population of this species breeds on St. George. In addition, several other seabirds that breed on the Pribilofs are near the edges of their species ranges, increasing the probability that small environmental changes may push them to local extinction on the Pribilofs. (Sinha-OEIS)
W80-05523

SHOREBIRD DEPENDENCE ON ARCTIC LITTORAL HABITATS,
California Univ., Bodega Bay, CA. Bodega Marine Lab.
P. G. Connors, and R. W. Risebrough.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 271-329, October 1979. 15 Tab, 26 Ref, 2 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-5-022-84.

Descriptors: *Shore birds, *Habitats, *Water pollution effects, *Environmental effects, Littoral, Oil pollution, Resources development, Alaska, *Outer Continental Shelf, Petroleum development, Charadriiformes.

Shorebirds (sandpipers, plovers, and their relatives) are a major and important component of the Alaskan arctic avifauna. Studies of bird use of disturbed habitats indicate that coastal oil development will affect arctic shorebird populations. A loss in local bird populations are anticipated due to destruction of habitat associated with any construction on land, and an additional loss due to changes in the quality of habitat associated with any construction. Whether these construction effects, or the direct effects of potential oil spills will have a meaningful impact on species populations will depend on the areal extent of the development or oil spill, in combination with the particular biological and geographic features of the site. The trophic system of principal activity in the Beaufort littoral zone involves foraging by many species on marine zooplankton along shorelines. In the southern Chukchi, the greatest activity centers on mudflats and saltmarsh areas, where high concentrations of several shorebird species forage on benthic invertebrates. This difference between areas implies corresponding differences in the sensitivity of bird populations to environmental disturbances. (Sinha-OEIS)
W80-05524

THE DISTRIBUTION, ABUNDANCE AND FEEDING ECOLOGY OF BIRDS ASSOCIATED WITH PACK ICE,
Point Reyes Bird Observatory, Stinson Beach, CA.
G. J. Divoky, and A. E. Good.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol I, Receptors--Mammals--Birds, p 330-599, October 1979. 126 Fig, 31 Tab, 20 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 02-7-022-35410.

Descriptors: *Sea ice, *Birds, *Oil pollution, *Water pollution effects, Resources development, Environmental effects, Baseline studies, Alaska, Oil spills, *Outer Continental Shelf, Pack ice, Petroleum development, Beaufort Sea.

As part of the environmental assessment of the outer continental shelf of Alaska the distribution, abundance and feeding ecology of seabirds associated with pack ice are being studied. An attempt is being made to determine the critical species and habitat associated with the pack ice. This document reports bird use of the nearshore Beaufort Sea from June through October and provides information on where and when oil development will have the most detrimental impacts on bird populations. The ice environment of the Bering, Chukchi and Beaufort seas will present unique problems to those involved in the exploitation of oil and gas reserves. The dynamic aspects of pack ice and the severe temperatures associated with it increase the chances of mechanical and human error causing incidents which could prove harmful to biological systems. In the pack ice the biological systems that will be impacted by such incidents could be expected to be less resilient than those in areas further south. Birds are typically one of the most obvious and immediate victims of oil spills. Direct mortality is caused by oil fouling feathers resulting in loss of insulation, stress and possible ingestion of oil. More subtle effects are caused by the impacts of oil on the lower levels of trophic webs. Oil spilled in the pack ice will spread out in areas of open water such as leads and polynas. Because these are the areas where birds are concentrated in the ice, the chances of birds coming in contact with spilled oil are greater in the ice than in open water. (Sinha-OEIS)
W80-05525

EFFECTS OF OILING ON TEMPERATURE REGULATION IN SEA OTTERS,
Scripps Institution of Oceanography, La Jolla, CA.
G. L. Kooyman, and D. P. Costa.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 1-26, October 1979. 7 Fig, 4 Tab, 16 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-7-022-35130.

Descriptors: *Water pollution effects, *Oil pollution, *Otters, Metabolism, Environmental effects, Baseline studies, Resources development, Alaska, California, *Outer Continental Shelf, Petroleum development, Temperature regulation, Crude oil, Enhydra lutris.

The objective of this study was to measure effects of crude oil contamination on sea otters through studies on the changes in the animals' metabolic rate and subcutaneous temperatures before and after contact with oil. A second objective was to attempt to rehabilitate the otters after crude oil contamination. The study has shown that small amounts of crude oil contamination have large effects on the metabolic rate of sea otters. Light oiling of approximately 25% of the animal's pelt surface area resulted in a 1.4X increase in metabolic rate while immersed in water at 15C. Furthermore, when the oil was removed by detergent, the animal's metabolic rate increased 2.1X while immersed in water at 15C. Of the three animals studied two contracted pneumonia and one died. Any contact with oil at any time of year would have a profound influence on the health of individual sea otters through increases in the animal's thermal conductance and the subsequent increase in metabolic rate. It is probable that death may follow from pneumonia or hypothermia depending upon the amount of the animal's fur fouled. Rehabilitation of oil-fouled sea otters would be very costly requiring holding facilities to keep the animals for at least two weeks, and the success rate is likely to be rather low. (Sinha-OEIS)
W80-05526

LETHAL AND SUBLETHAL EFFECTS ON SELECTED ALASKAN MARINE SPECIES AFTER ACUTE AND LONG-TERM EXPOSURE TO OIL AND OIL COMPONENTS,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
S. D. Rice, and J. F. Karinen.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 27-59, October 1979. 2 Tab, 32 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Water pollution effects, *Aquatic life, *Oil pollution, *Environmental effects, Arctic, Resources development, Alaska, Temperature, Toxicity, Marine biology, *Outer Continental Shelf, Petroleum development.

The FY 1979 program involves physiological and bioassay tests of applied research on species indigenous to the Gulf of Alaska, Bering Sea, and Beaufort Sea. The major emphasis of research has shifted from strictly descriptive acute toxicity determinations to mechanistic studies, sublethal tests, and long-term exposures that will eventually allow prediction of oil impact on the biota. Because low temperature appears to be such an important factor in governing the sensitivity of some subarctic species to oil it is necessary to determine whether this relationship holds for similar Arctic species or Arctic species in general. A base of information has now been accumulated on acute toxicity, sublethal effects, relative toxicity of oil aromatics, effects of various environmental factors on these parameters, and effect on larvae; but this is only a small part of the information needed to predict and evaluate the major impacts of hydrocarbons in the marine environment. This study has given more knowledge about the effects of temperature and salinity on the ability of subarctic organisms to metabolize, eliminate or recover from petroleum exposure. (Sinha-OEIS)
W80-05527

RESEARCH TO DETERMINE THE ACCUMULATION OF ORGANIC CONSTITUENTS AND HEAVY METALS FROM PETROLEUM-IMPACTED SEDIMENTS BY MARINE DETRITIVORES OF THE ALASKAN OUTER CONTINENTAL SHELF,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Research Lab.
J. W. Anderson, J. M. Augenfeld, E. A. Crecelius, and R. G. Riley.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 172-234, October 1979. 11 Fig, 18 Tab, 23 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 2311102778.

Descriptors: *Water pollution effects, *Oil pollution, *Heavy metals, *Sediments, Weathering, Environmental effects, Alaska, *Outer Continental Shelf, Petroleum development, Prudhoe Bay crude oil, Macoma inquinata, Protothaca staminea, Abarenicola pacifica.

Prudhoe Bay crude oil was weathered 24 days under different conditions of light and agitation. The weathering resulted in the complete disappearance of light saturate (C8 to C10) compounds and of most monoaromatics under all conditions. Severe agitation and exposure to light caused the disappearance of 72% or more of the heavier saturates (up to C26) and of 49% or more of the diaromatics. A relative enrichment of triaromatics was observed. Gentler agitation and protection from light had qualitatively similar effects but to a lesser degree. Macoma inquinata were exposed to detritus, containing neutron activated native metals, in the presence and absence of 1000 ppm Prudhoe Bay crude oil. Oil did not enhance the net uptake of Fe, Zn, Co, or Cr, but did reduce the feeding rate of the clams in comparison with the controls. Protothaca staminea were exposed to 1200 ppm Prudhoe Bay crude oil in the field for 54 days. Eighty-five percent of the group survived, compared to 17% of a similar group of Macoma. It was concluded that the suspension feeder Protothaca suffers less stress as a result of exposure to oiled sediment than the detritus feeder Macoma. Lugworms (Abarenicola pacifica) were exposed to sediment containing 250 to 1000 ppm Prudhoe Bay crude oil. In control animals a marked negative regression of weight-specific feeding rate on body size was found. Exposure to oil at high levels abolished this regression by depressing the rate more in smaller individuals. (Sinha-OEIS)
W80-05528

BEAUFORT SEA BARRIER ISLAND-LAGOON ECOLOGICAL PROCESS STUDIES. ECOLOGY OF FISHES IN SIMPSON LAGOON, BEAUFORT SEA, ALASKA,
LGL Ltd., Nanaimo (British Columbia).
P. C. Craig, and L. Haldorson.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol VI, Effects, p 363-470, October 1979. 22 Fig, 15 Tab, 36 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. 03-6-022-35193.

Descriptors: *Fish, *Ecology, *Environmental effects, *Water pollution effects, Marine fish, Resources development, Oil pollution, Habitat, Freshwater fish, *Outer Continental Shelf, Beaufort Sea, Simpson Lagoon, Environmental impact, Ecological crisis, Habitat disturbance, Anadromous fish, Petroleum development.

On going petroleum activities at Prudhoe Bay and the recent construction of the trans-Alaska pipeline demonstrate the nature of demands industry makes on arctic water and gravel resources, and the subsequent disruptions of habitat and inevitable oil spills. As part of the program to assess the environmental impacts of offshore petroleum development, it is necessary to understand the utilization of nearshore habitats by anadromous and marine fish populations. The present study examines nearshore fishes and their ecological role in a barrier island-lagoon complex along the Beaufort Sea coast to evaluate in what ways petroleum development may affect fish populations. It appears that nearshore waters are used in the winter by some marine species for feeding and/or spawning, and that selected nearshore sites are used by anadromous fish for feeding and overwintering. In summer, with the exception of shallow-water areas that freeze solid or become hypersaline, the nearshore coastal environment supports year-round populations of fish, though numbers, species composition and distribution differ between summer and winter periods. (Sinha-OEIS)
W80-05529

ECOLOGICAL STUDIES OF COLONIAL SEABIRDS AT CAPE THOMPSON AND CAPE LISBURNE, ALASKA,
Ecological Research Associates, Fairbanks, AK.
A. M. Springer, D. G. Roseneau, and M. Johnson.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol II, Receptors--Birds, p 517-574, October 1979. 18 Fig, 12 Tab, 26 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-35210.

Descriptors: *Birds, *Ecology, *Environmental effects, *Water pollution effects, Monitoring, Sea-

sons, Ecosystems, Alaska, Resources development, *Outer Continental Shelf, Chukchi Sea, Petroleum development.

The objective of this study was to provide current information on the ecology of seabirds nesting at Cape Thompson and at Cape Lisburne. The data obtained at Cape Thompson was compared to recent historical studies in an attempt to describe 'predevelopment' changes which may have occurred. Investigations at Cape Lisburne further increase understanding of seabird biology in the Chukchi Sea. By broadening the ecological data base, effects of resource development in this region may be more accurately measured. The colonies at Cape Thompson, Cape Lewis and Cape Lisburne support most of the breeding seabirds in the eastern Chukchi Sea. The birds constitute a major component of the ecosystem in this region. Perturbations of the environment by resource development in the Hope Basin could threaten the health and stability of these populations. Data acquired during three field seasons have demonstrated that the success of seabirds nesting at colonies in the eastern Chukchi can vary dramatically between years. The causes appear to have been fluctuations in the birds' prey base, fluctuations which have probably been precipitated by one or a combination of environmental factors. These changes, however, appear to be short-lived probably seldom longer than one season, and the 'average' environment is one in which seabirds have prospered over the long run. (Sinha-OEIS)
W80-05530

THE DISTRIBUTION, ABUNDANCE, DIVERSITY AND PRODUCTIVITY OF THE WESTERN BEAUFORT SEA BENTHOS,
Oregon State Univ., Corvallis. School of Oceanograpy.
A. G. Carey, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol III, Receptors--Fish, Littoral, Benthos, p 208-360, October 1979. 21 Fig, 7 Tab, 18 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-68.

Descriptors: *Benthos, *Food webs, *Ecosystems, *Baseline studies, Oil pollution, Environmental effects, Resources development, Alaska, Water pollution effects, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

Extensive exploration and development for oil and gas on the Alaskan and Canadian continental shelf have the potential to significantly influence the marine environment of the Beaufort Sea. It is impossible with our present knowledge to accurately predict the consequences of petroleum development on the marine benthos. The past and continuing goal of this project has been to acquire the knowledge of the ecology of benthic invertebrate faunas of the Beaufort Sea continental shelf necessary to evaluate the consequences of offshore oil and gas development. The distribution and abundance of the fauna has been examined in detail with studies of the spatial and temporal variability of these. These data will provide a baseline against which future changes in the benthic environment and community structure can be evaluated. Of current importance are: (1) the definition of temporal changes in sublittoral community structure, (2) the determination of the life histories and secondary production estimates of dominant and ecologically important species, (3) the description of the benthic food web, and (4) the study of the ecology of benthic invertebrates important as prey organisms to the marine mammals, birds, and fishes. Now that broad ecological patterns of benthic invertebrates on the Beaufort Sea shelf are becoming fairly well known, it is imperative to define the dynamic processes maintaining temporal and spatial structure. (Sinha-OEIS)
W80-05531

BEAUFORT SEA PLANKTON STUDIES,
R. A. Horner.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol III, Receptors--Fish, Littoral, Benthos, p 543-639, October 1979. 56 Fig, 5 Tab, 9 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-78-B01-6.

Descriptors: *Plankton, *Ecosystems, *Winter, *Baseline studies, Sampling, Water pollution effects, Environmental effects, Oil pollution, Resources development, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development, Seasonal variations, Environmental impact.

As primary producers and primary and secondary consumers, phytoplankton and zooplankton are important in the Beaufort Sea ecosystem. The specific objectives of this project are to assess the winter density distribution and environmental requirements of zooplankton and phytoplankton in the nearshore areas of the Beaufort Sea in an integrated sampling effort with other Research Units and to analyze samples collected during the 1978 icebreaker cruise in the Beaufort Sea. Basic background information on standing stock, species composition, community structure, distribution, and primary production of plankton communities in the Beaufort Sea lease area in winter is generally not known. This kind of information is necessary in order to assess damage in case of a spill. Knowledge of winter biological activity is especially important in light of the State of Alaska draft regulations that limit exploratory drilling to the winter. (Sinha-OEIS)
W80-05532

ASSESSMENT OF POTENTIAL INTERACTIONS OF MICROORGANISMS AND POLLUTANTS RESULTING FROM PETROLEUM DEVELOPMENT ON THE OUTER CONTINENTAL SHELF OF ALASKA,
Louisville Univ., KY. Dept. of Biology.
R. M. Atlas.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 1-61, October 1979. 2 Fig, 7 Tab. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-85.

Descriptors: *Microorganisms, *Biodegradation, *Sediments, *Denitrification, Surveys, Baseline studies, Resources development, Water pollution effects, Environmental effects, Alaska, *Outer Continental Shelf, Beaufort Sea, Cook Inlet, Petroleum development.

This study is a continuation of an effort to characterize microbial populations and the ability of microorganisms to biodegrade petroleum hydrocarbons in proposed Alaskan OCS oil and gas lease areas. The approach has been to determine the distribution and population levels of several microbiological groups, e.g., hydrocarbon degraders within a geographic area, to extensively characterize selected microorganisms and using numerical taxonomy to determine the diversity of the microbial community and an inventory of the dominant microbial taxa within the geographic area. During this year microbial populations were characterized within Cook Inlet and the Beaufort Sea. Studies were begun to develop a probabilistic identification matrrix for bacterial populations in Alaskan OCS areas. Intensive surveys have been conducted to determine the biodegradation potential of indigenous microbial populations for petroleum hydrocarbons. During the past year hydrocarbon biodegradation potentials were estimated within Cook Inlet and the Beaufort Sea. Denitrification potentials were also determined for sediment samples collected in the Beaufort Sea. In addition, intensive studies were continued in the Beaufort Sea to follow the chemical changes in crude oil as it undergoes biotic (biodegradation) and abiotic (physical and chemical) weathering in sediment. (Sinha-OEIS)
W80-05533

STUDY OF MICROBIAL ACTIVITY AND CRUDE OIL-MICROBIAL INTERACTIONS IN THE WATERS AND SEDIMENTS OF COOK INLET AND THE BEAUFORT SEA,
Oregon State Univ., Corvallis. Dept. of Microbiology.
R. P. Griffiths, and R. Y. Morita.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 62-142, October 1979. 16 Fig, 28 Tab, 11 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-68.

Descriptors: *Microorganisms, *Food chains, *Nitrogen fixation, *Respiration, Oil pollution, Water pollution effects, Baseline studies, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, Crude oil, Nutrient cycles, Petroleum development, Beaufort Sea, Cook Inlet.

During the last year information was obtained about marine microbial function in the Beaufort Sea and Cook Inlet, Alaska and about the effects of crude oil on specific processes. The microbial functions were relative microbial activity and respiration (mineralization) in surface waters and sediments and rates of nitrogen fixation in the sediments. It was concluded that the presence of crude oil decreases the rate at which natural marine microbial populations take up and mineralize (respire) nutrients. Crude oil thus acts as an environmental stress on this segment of the biosphere. It was also observed that crude oil significantly reduces both protozoan growth rates and the rates of bacterial ingestion (cropping rate). This means that the presence of crude oil could greatly reduce the rate by which nutrients are passed through the detrital food chain from sediments to higher trophic levels via the transformation of dissolved organic matter into bacterial cells which, in turn, are eaten by protozoan. The protozoans are then eaten by higher forms. The major area of concern is the interaction between the crude oil that might be accidently spilled during the course of petroleum production in potential lease areas and the microorganisms present that might be perturbed by such a spill. (Sinha-OEIS)
W80-05534

DISTRIBUTION AND DYNAMICS OF HEAVY METALS IN ALASKAN SHELF ENVIRONMENTS SUBJECT TO OIL DEVELOPMENT,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 5B.
W80-05535

HYDROCARBONS: NATURAL DISTRIBUTION AND DYNAMICS ON THE ALASKAN OUTER CONTINENTAL SHELF,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. G. Shaw, P. Else, G. Malinky, G. Mapes, and D. McIntosh.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol V, Receptors--Microbiology, Contaminant Baselines, p 547-596, October 1979. 3 Fig, 5 Tab, 12 Ref, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Baseline studies, *Dispersion, *Benthos, *Water pollution effects, Environmental effects, Resources development, Alaska, Oil pollution, *Outer Continental Shelf, Cook Inlet, Hydrocarbons, Petroleum development.

A continuing study of the distribution and dynamics of hydrocarbons on Alaska's outer continental shelves and coastal waters has two interrelated goals: to describe the ambient kinds and amounts of hydrocarbons in Alaskan marine environments which may be affected by potential petroleum development and to better understand the processes by which petroleum is dispersed and degraded in the marine environment regimes found around Alaska. The primary emphasis of this year's work has been directed toward addressing these general

topics in one particular geographic region: Cook Inlet. Hydrocarbons in pelagic and benthic environments of Cook Inlet have been measured in order to improve knowledge of ambient concentrations and to understand more about transfer and dispersion processes. Results indicate that in the pelagic environment of Cook Inlet hydrocarbon concentrations are generally low and that in the upper Inlet any discharged petroleum is rapidly dispersed. Uptake of fossil hydrocarbons by benthic animals in lower Cook Inlet occurs in quite specific ways. (Sinha-OEIS)
W80-05536

NITROGEN UPTAKE BY TROPICAL FRESHWATER MACROPHYTES,
Guam Univ., Agana. Water Resources Research Center.
S. G. Nelson, B. D. Smith, and B. R. Best.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-194228, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 10, 1980. 21 p, 5 Fig, 3 Tab, 19 Ref. OWRT A-014-GUAM(1), 14-34-0001-9012.

Descriptors: *Tropical regions, *Freshwater plants, *Nitrogen, Effects, Wet climates, Floating plants, Submerged plants, Ammonia, Nitrates, Nitrogen uptake, *Guam, Micronesia, Mariana Islands.

The kinetics of nitrogen uptake were examined for three species of aquatic macrophytes which are common on Guam. Nitrate-nitrogen and ammonium-nitrogen uptake by Pistia stratiotes were monitored in response to a wide range of substrate concentrations. First order kinetics of nitrate-nitrogen uptake were examined for Pistia stratiotes, Hydrilla verticillata and Microspora sp. Uptake rates were higher after twenty-four hours of exposure to the nitrate source than immediately after exposure. The rate of uptake of nitrate-nitrogen by P. stratiotes was greater in the light than in the dark. Nitrate uptake followed a pattern which could be described by the Michaelis-Menton expression. Rates of ammonium-nitrogen uptake were similar in the dark and in the light. Ammonium-nitrogen uptake response to substrate concentration appeared to be linear. For any given dissolved nitrogen concentration, the rate of ammonium-nitrogen uptake was greater than the rate of nitrate-nitrogen uptake.
W80-05539

THE DETECTION OF MUTAGENIC POLLUTANTS IN AQUATIC AND MARINE ENVIRONMENTS: STUDIES OF THE MILLERS RIVER AND BOSTON HARBOR,
Massachusetts Univ., Amherst. Dept. of Botany.
E. J. Klekowski, and W. Barnes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193899, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Massachusetts Publication No 111, 1980. 74 p, 4 Fig, 9 Tab, 53 Ref. OWRT B-053-MASS(8), 14-34-0001-6087.

Descriptors: *Ames test, *Mussels, *Ferns, *Mutagen, *Carcinogen, *Bioassay, *Bioconcentrator, *Pollution, *Marine, Salmonella, Recycling, Somatic crossing over, Soybean, Mutation, Twinspot, Waste water(Pollution), Paper recycling, Rivers, Harbors, *Boston Harbor.

Recent research indicates that the majority of human carcinogens are mutagens and that a significant number of mutagens are also carcinogenic. Because of this relationship, the development of techniques to determine if mutagenic pollutants are present in environments is significant. Techniques were developed to screen aquatic and marine environments for mutagenic pollutants. Three different assay protocols were studied: (1) an in-situ mutagen bioassay based upon measurements of genetic damage to indigenous members of the biota (ferns), (2) the use of bioconcentrators to accumulate mutagens (mussels) and the testing of tissue extracts with microbial assays, and (3) the physical sampling and extraction of pollutants in the environment and assaying with microbial mutagen assays. Two environments were studied with these techniques, mutagens were detected in the Millers River and mutagens were not detected in Boston Harbor. (Godfrey-Mass)
W80-05541

BACTERIA: GOOD, BAD AND INDIFFERENT,
National Water Well Association, Worthington, OH.
S. Smith.
Water Well Journal, Vol 34, No 3, p 74-75, March, 1980.

Descriptors: *Pathogenic bacteria, *Iron bacteria, *Sulfur bacteria, *Aquatic bacteria, Aquifers, Water wells, Disinfection, Chlorination, Soil bacteria, Aerobic bacteria, Anaerobic bacteria, Spores, Water pollution sources, Coliforms, Diseases.

Factors in the subsurface environment that limit the occurrence of bacteria are: lack of space, hydrostatic pressure, osmotic pressure, salinity, high temperature, and lack of dissolved oxygen. Three types of bacteria that can exist in an aquifer are: beneficial soil bacteria, dangerous coliform and other pathogenic forms, and annoying types such as iron bacteria. Iron bacteria grow in wells and form slimey masses which are corrosive to piping and well equipment. Sulfur bacteria produce hydrogen sulfide gas and corrosion of metal pipe. Few pathogenic bacteria thrive in an aquifer but some can survive by forming a tough shell. These include the bacteria that cause anthrax, tetanus, botulism, cholera, typhoid fever, dysentery, diarrhea, tularemia, tuberculosis and gastroenteritis. Most of these bacteria are resistant to chlorination and water containing them must be pressure-sterilized for up to an hour. Bacterial contamination can come from sewage wastes, recharge from polluted runoff, seepage from landfills and cemeteries, contaminated well tools, and waste injection wells. Once an aquifer is contaminated it tends to remain contaminated for a long period of time. (Purdin-NWWA)
W80-05560

TOXICITY ASSESSMENT OF TREATED MUNICIPAL EFFLUENTS,
Environmental Protection Service, Burlington (Ontario). Waste Water Technology Centre.
S. Metikosh, V. W. Cairns, and B. E. Jank.
Technology Development Report EPS 4-WP-80-1, February 1980. 43 p, 12 Fig, 11 Tab, 25 Ref.

Descriptors: *Toxicity, *Water pollution effects, *Waste water treatment, Effluents, Industrial wastes, Bioassay, Rainbow trout, Municipal wastes, Seasonal, Environmental effects, Activated sludge, Water sampling, Biochemical oxygen demand.

The acute lethality of undiluted primary and secondary effluents from 24 municipal activated sludge plants and final effluents from 5 waste stabilization ponds was studied using samples collected before chlorination to eliminate toxicity due to residual chlorine. Twenty-nine municipal waste water treatment plants in southern Ontario were selected on the basis of design, operating efficiency, influent characteristics, and location. Plants used in the study included conventional activated sludge plants, extended aeration activated sludge plants, waste stabilization ponds, and a waste stabilization pond system with an aerated cell. Comparisons were also made of the toxicity removal capabilities of each treatment type in the categories of totally domestic, domestic with minor industrial input, and domestic with major industrial input. A minimum of nine samples was collected from each plant and samples were taken in both summer and winter. Bioassays for acute lethality were conducted with juvenile rainbow trout. All primary effluents were acutely lethal to the trout, probably due to high concentrations of ammonia and anionic surfactants. During the summer, 75% of the secondary effluents were non-acutely lethal and during the winter, 45% were non-acutely lethal. Toxicity removal was found to depend on the operating efficiency of individual systems. Samples from systems that produced good quality, nitrified effluent were consistently non-acutely lethal. (Seigler-IPA)
W80-05563

SOURCES,
Hydroscience, Inc., Westwood, NJ.
For primary bibliographic entry see Field 5B.
W80-05568

ESTUARIES,
San Diego State Univ., CA. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2L.
W80-05569

COASTAL AND OPEN OCEAN SCIENCE,
Rhode Island Univ., Kingston. School of Oceanography.
For primary bibliographic entry see Field 5B.
W80-05570

DEEPWATER DUMPSITE 106,
Woods Hole Oceanographic Institution, MA.
G. Csanady, G. Flierl, D. Karl, D. Kester, and T. O'Connor.
In: Proceedings of a Workshop on Assimilative Capacity of U.S. Coastal Waters for Pollutants, Crystal Mountain, Washington, July 29-August 4, 1979, p 123-147, December 1979. 9 Fig, 1 Tab, 22 Ref, Working Paper No 1: Federal Plan for Ocean Pollution Research Development and Monitoring, FY 1981-1985. NOAA, Environmental Research Laboratories, Boulder, Colorado.

Descriptors: *Waste disposal, *Environmental effects, *Water pollution sources, Water pollution effects, Industrial wastes, Model studies, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Assimilative capacity.

Deepwater Dumpsite (DWD) 106 is southeast of the entrance to New York Harbor and in an area beyond the edge of the continental shelf. It has been a site for regulated disposal of industrial and some municipal wastes since 1972. This chapter deals jointly with the capacity of the present DWD 106 site to assimilate the wastes and that of the entire region of the continental slope in the vicinity, which possesses similar physical, biological and chemical characteristics. First, knowledge relating to biological effects of waste in the DWD 106 environment, chemical transformations of interest and physical properties of the site is reviewed. Second, the assimilative capacity of the site is quantified by means of various simple models. Finally, recommendations are made for future work to substantiate existing ideas, test current theories and improve models, all with the aim of making estimates of assimilative capacity more reliable. (Sinha-OEIS)
W80-05571

THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Atmospheric Labs.
D. Atwood, D. W. Brown, V. Cabelli, J. Farrington, and C. Garside.
In: Proceedings of a Workshop on Assimilative Capacity of U.S. Coastal Waters for Pollutants, Crystal Mountain, Washington, July 29-August 4, 1979, p 148-178, December 1979. 5 Fig, 5 Tab, 73 Ref, Working Paper No 1: Federal Plan for Ocean Pollution Research Development and Monitoring, FY 1981-1985. NOAA, Environmental Research Laboratories, Boulder, Colorado.

Descriptors: *Waste disposal, *Pollutants, *Water pollution sources, *Water pollution effects, Environmental effects, Trace elements, Polychlorinated biphenols, Eutrophication, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Assimilative capacity.

A few representative, fairly well understood contaminants were selected for consideration. The impacts chosen for use in the analyses are those that constitute radical changes in the ecosystem or threats to human health. Microbial contamination is probably the most straightforward issue ad-

dressed. The panel selected the polychlorinated biphenyls (PCB's) as representative of this class of contaminants and as a group for which some biogeochemical data are available. Threat to human health from finfish consumption was chosen as the critical impact function. Cadmium was chosen as representative of contaminant trace metals, and again threat to human health (through the consumption of edible fish and shellfish) was selected as the impact function. Contamination by excess nitrogen was chosen because it is a particularly bioactive substance, intimately linked to biological productivity and to the ecosystem generally, and because it is a subject of present concern in the New York Bight in connection with sewage system engineering practices. Anoxia, as a result of excess plankton production and ensuing eutrophication, was identified as the critical impact function. This selection of contaminants and impacts exemplified the diversity of time and space scales that must enter into consideration of regional assimilative capacity. (Sinha-OEIS)
W80-05572

SOUTHERN CALIFORNIA BIGHT,
Southern California Coastal Water Research Project, Long Beach.
W. Bascom, N. Brooks, R. Eppley, T. Hendricks, and G. Knaver.
In: Proceedings of a Workshop on Assimilative Capacity of U.S. Coastal Waters for Pollutants, Crystal Mountain, Washington, July 29-August 4, 1979, p 179-242, December 1979. 4 Fig, 21 Tab, 68 Ref, Append, Working Paper No 1: Federal Plan for Ocean Pollution Research Development and Monitoring, FY 1981-1985. NOAA, Environmental Research Laboratories, Boulder, Colorado.

Descriptors: *Waste disposal, *Water pollution effects, *Environmental effects, Monitoring, Baseline studies, Ecosystems, California, *Outer Continental Shelf, *Ocean dumping, *Southern California Bight, Assimilative capacity.

The Southern California Bight is a large open bay that extends from Point Conception on the northwest to the Mexican border more than 500 km to the south. The topography of the continental borderland in this region is unlike any other in the world. A great deal is known about the results of waste discharges in the Southern California Bight. The actual effects of wastes on the various plant and animal populations at any location can be compared with a group of 28 control stations which represent natural California conditions at depths similar to those where effects have been noted. It seems evident that the coastal waters are not now overloaded except in small areas and specific ways. It does not appear that the wastes to be discharged after 1981 (when improved source control and treatment are in effect) will approach the assimilative capacity of the coastal waters of California. Continued and careful monitoring of the chemical characteristics of the effluent and of the health of the biological community must continue. Because of increased scientific knowledge of initial dilution, advection and dispersion, chemical conversions, and sedimentation, biological uptake, and human health, ecological and aesthetic effects, there is reasonable ability to predict the effects (and thus the benefits) of changes in discharge practices. (Sinha-OEIS)
W80-05573

PUGET SOUND,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
J. Cline, H. Curl, L. Codispoti, C. Ebbesmeyer, and H. S. Harris.
In: Proceedings of a Workshop on Assimilative Capacity of U.S. Coastal Waters for Pollutants, Crystal Mountain, Washington, July 29-August 4, 1979, p 243-280, December 1979. 3 Fig, 7 Tab, 59 Ref, Working Paper No 1: Federal Plan for Ocean Pollution Research Development and Monitoring, FY 1981-1985. NOAA, Environmental Research Laboratories, Boulder, Colorado.

Descriptors: *Waste disposal, *Water pollution effects, *Environmental effects, Ecosystems, Polychlorinated biphenols, Water pollution sources, Washington, *Outer Continental Shelf, *Ocean dumping, Puget Sound(WA), Assimilative capacity.

A complicating factor in assessing the assimilative capacity of certain areas in Puget Sound is the presence of persistent pollutants discharged in years past. Examples are the high concentrations of PCB's in the lower Duwamish River and Elliott Bay and various synthetic organic chemicals in Commencement Bay. Presumably the amount of these substances reaching these waters is significantly less now than in prior years and will be even less in the future. However, the persistence of these substances in the marine ecosystem is such that many years following the reduction or elimination of the discharge are necessary to reduce the concentrations to acceptable levels. Although the evidence is inconclusive at present, these substances appear to be associated with various abnormalities in flatfish. It is thus possible that the assimilative capacity of these waters has already been fully utilized. (Sinha-OEIS)
W80-05574

A COMPARISON OF WEATHERING PROCESSES OF OIL FROM THE BRAVO AND THE IXTOC BLOWOUTS,
Continental Shelf Inst., Trondheim (Norway).
T. Haegh, and L. I. Rossemyr.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Volume 1, p 237-244, 1980. 6 Fig, 3 Tab, 14 Ref, OTC-3702. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Oil spills, *Weathering, *Water pollution effects, *Oil pollution, Path of pollutants, Resources development, Environmental effects, Baseline studies, *Outer Continental Shelf, North Sea, Gulf of Mexico, Petroleum development, Blowouts.

In spite of differences in the type of blowout, climatic conditions and amount of oil from the two blowouts, there is a surprising similarity in the physical and chemical characteristics. The visual observations state that the slicks pass the same physical stages which can easily be divided into 5 distinct categories (in some cases also in substages such as pancakes, lump stripes, etc.). Further, each stage seems to have more or less the same range of physical characteristics concerning loss of light components, viscosity and water-uptake (water-in-oil emulsion). Observations also indicate that the use of different conventional oil combating techniques are only successful within a limited range of physical stages of the oil. (Sinha-OEIS)
W80-05575

OPEN OCEAN POLLUTION RESPONSE -- THE COAST GUARD SYSTEM,
For primary bibliographic entry see Field 5G.
W80-05576

ENVIRONMENTAL PERMITTING FOR DRILLING IN OFFSHORE AREAS: COMMENTS ON THE SELECTION PROCESS FOR DRILLING FLUIDS,
M. M. Jones.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Volume 1, p 255-262, 1980. 4 Fig, 2 Tab, 51 Ref. OTC-3705. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Drilling fluids, *Oil industry, *Toxicity, Testing procedures, *Water pollution effects, Environmental effects, Baseline studies, Biota, Pollution abatement, Shrimp, Alaska, Decision making, *Outer Continental Shelf, Petroleum development.

The decision-making process is examined with regard to the selection of drilling fluids in obtaining environmental permits for offshore drilling. Increased exploration and production in offshore areas has been linked to heightened environmental concerns for the impact of drilling fluids on the existing biota. As an example of the decision-making process, a case study of toxicity testing on two mud additives (a defoamant and a lubricant) for use in the Alaskan Outer Continental Shelf (OCS) is presented. Acute toxicity tests results with brine shrimp nauplii (Artemia salina) are presented and compared to recommended application rates. The ensuing decision-making process is briefly described and the final regulatory and corporate decisions to accept one and reject the other are discussed. Existing hierarchical toxicity testing protocols (developed primarily for pesticides) are reviewed for their sensitivity to many biological, chemical, logistical, and economic constriants specific to drilling fluids. A modified toxicity testing protocol is presented which considers the factors and can be expanded for additional consideration of site-specific factors. (Sinha-OEIS)
W80-05577

ENVIRONMENTAL MONITORING ASSOCIATED WITH A PRODUCTION PLATFORM IN THE GULF OF MEXICO,
Continental Shelf Associates, Inc., Tequesta, FL.
For primary bibliographic entry see Field 5B.
W80-05578

POTENTIAL SCHEMES FOR OFFSHORE LABRADOR YEAR ROUND PRODUCTION,
V. F. Wetzel, D. M. Berenger, and M. M. Jozan.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Volume 1, p 293-305, 1980. 9 Fig, 16 Ref, OTC 3711. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Hazards, *Exploration, *Icebergs, *Offshore platforms, Baseline studies, Hydrodynamics, Resources development, Pipelines, Shore protection, Oil pollution, Gases, *Outer Continental Shelf, Labrador, Year round production, Petroleum development, Environmental conditions.

Oil companies are currently involved in an extensive exploratory program off the Canadian east coast. Total Eastcan, operator for the Labrador Group of Companies, has made three gas discoveries offshore Labrador. The discoveries justified the undertaking of studies to determine the feasibility of different production schemes. Solutions already developed for the offshore areas, such as the North Sea, are only partially adaptable because of the specific environmental conditions (moving ice pack six months of the year, icebergs all year round which many damage surface and bottom facilities). Due to similar environmental conditions, solutions acceptable for Labrador could probably be very easily adapted to other areas off the eastern Canadian coast. This paper presents a summary of environmental conditions with their impact on production schemes. The results of feasibility studies consist of a floating scheme equipped with ice cutting capabilities. This scheme was initially developed for operation during the ice free season and consisted of a dynamically positioned production platform with off loading by tanker. (Sinha-OEIS)
W80-05579

SPECTRAL WAVE FORECAST ANALYSIS AND OPERATIONAL EVALUATION FOR OFFSHORE LABRADOR OIL EXPLORATION,
J. G. Hayes, G. MacMillan, and A. Mignone.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Vol 1, p oim-330, 1980. 2 Fig, 2 Ref. OTC-3716. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Hazards, *Exploration, *Waves(Water), Resources development, Baseline studies, Pollution abatement, Water pollution control, Drilling, Oil pollution, Decision making, Environmental effects, Oil industry, *Outer Continental Shelf, Labrador, Davis Strait, Wave spectra forecasts, Petroleum development.

Offshore oil exploration has recently moved into deeper more hostile waters than ever before. This has created a need for timely, more informative

offshore environmental forecasts, for example in the recent drilling activity off Eastern Canada near Labrador and the Davis Straits. During the 1979 drilling season, spectral wave forecasts were produced for three offshore drill sites for the Total Eastcan drillships 'Petrel', 'Pelican' and 'Pelerin.' Waverider buoys within one kilometer of each vessel supplied three-hourly wave data to verify the detailed directional wave spectra forecasts, with projections out to 72 hours. The need for spectral wave forecasts in support of offshore drilling is discussed with particular attention focused on the response of drillships to local sea and propagaged swell into the drillsite areas. The dependence on buoy observations as well as real time communications via satellite for remote drilling regions is discussed. Plans for future advances in numerical wave modeling and real-time data collection platform (DCP) technology are discussed. Buoy to satellite DCP advances are described for use in offshore environment decision making. (Sinha-OEIS)
W80-05580

HAZARDS ANALYSIS ON THE ATLANTIC OUTER CONTINENTAL SHELF.
For primary bibliographic entry see Field 5B.
W80-05581

DEEP OCEAN MINING POLLUTION MITIGATION,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 5G.
W80-05582

THE ENVIRONMENTAL GEOLOGY AND GEOMORPHOLOGY OF THE BARRIER ISLAND - LAGOON SYSTEM ALONG THE BEAUFORT SEA COASTAL PLAIN,
Alaska Univ., Fairbanks.
P. J. Cannon, and S. E. Rawlinson.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 209-248, October 1979. 21 Fig, 6 Tab. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-56.

Descriptors: *Hazards, *Geology, *Geomorphology, *Coasts, *Barrier islands, Baseline studies, Erosion, Remote sensing, Water pollution, Environmental effects, Alaska, Oil pollution, Resources development, *Environmental effects, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

This investigation provides quantitative and qualitative data for assessing the environmental impact of development within the lease area. The existing, naturally occurring geomorphic processes are identified, and where possible, the dynamics of these processes are quantified. The major landforms of the area, including barrier island, lagoons, streams, lakes, and deltas, are shaped or influenced by the loss of ground ice. Hence, there is an important interrelationship between the major landforms; a landform changes at the expense of another, or it evolves into another landform. This study provides an understanding of natural geomorphic conditions which exist in the area. This understanding can be used to determine the impact that man-related activities may have on the environment. The natural stability of geomorphic features should be known before long life structures are built. (Sinha-OEIS)
W80-05600

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 7B.
W80-05601

QUALITY ASSURANCE PROGRAM FOR TRACE PETROLEUM COMPONENT ANALYSIS,
NOAA National Analytical Facility, Seattle, WA.
For primary bibliographic entry see Field 5A.
W80-05602

ARCHIVAL OF VOUCHER SPECIMENS OF BIOLOGICAL MATERIALS COLLECTED UNDER THE OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM (OCSEAP) SUPPORT,
California Academy of Sciences, San Francisco, CA.
For primary bibliographic entry see Field 10A.
W80-05603

ARCTIC FOOD DEPENDENCY MATRIX: AN OCS MANAGEMENT TOOL,
Bureau of Land Management, Anchorage, AK. Alaska Outer Continental Shelf Office.
G. K. Bienek, and G. L. Hufford.
Marine Technology Society Journal, Vol 14, No 1, p 25-27, February-March 1980. 1 Fig, 3 Ref.

Descriptors: *Food webs, *Ecosystems, *Oil pollution, Arctic, Alaska, Resources development, Natural resources, *Outer Continental Shelf, *Beaufort Sea, Information resources, Petroleum development.

The food dependency matrix is a working document for the Alaskan Beaufort Sea, intended only to show simple food web relationships--who is eating what. It does not show seasonal variation, possible changes in feeding habits with different growth states, or relative quantities. However simple it is, the matrix does show the relative importance of certain species to other species. An important objective of this paper is to identify gaps in knowledge in hope that such information might lead to further research in time for the results to assist developers, regulatory agencies, and local residents in making wise decisions relating to future resource development activity in the coastal zone of the arctic Alaska. It is apparent from the matrix where much information for many groups is lacking. (Sinha-OEIS)
W80-05605

MANURE SPILLS MAY BE THREAT TO WATER SUPPLIES.
For primary bibliographic entry see Field 5B.
W80-05624

WIND-BLOWN DUST AS A SOURCE OF NUTRIENTS FOR AQUATIC PLANTS,
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-05668

IRON AND MANGANESE CONTENT OF RURAL DOMESTIC WATER,
L. H. Hileman.
Arkansas Farm Research, Vol 29, No 1, p 15, January-February, 1980. 1 Fig, 1 Tab.

Descriptors: *Iron, *Manganese, *Domestic water, *Arkansas, Water wells, Rural areas, Sampling, Water analysis, Water pollution, Ground water, Water pollution treatment, Filtration, Aesthetics.

Iron and manganese in domestic water may cause rust-colored stains on plumbing fixtures and yellow discoloration on clothes and dishes. These metals also impart a disagreeable taste to water. Deposits build up in pressure tanks, water heaters, and pipes, and clog water pumps. Although they are not health hazards, they should be removed from the water supply if they exceed certain limits (0.3 ppm for iron and 0.05 ppm for manganese) to avoid esthetic and economic damage and possible physiological effects. The iron and manganese contents of 2473 wells in Arkansas were analyzed between 1974 and 1977. The average iron content exceeded the 0.3 ppm limit in all districts. The amount of iron ranged from zero to 18.8 ppm. The average manganese content was 0.33 ppm with a range from zero to 13.6 ppm. The high iron and manganese contents of these wells may be due to low pH which increases the solubility of these metals. Treatment involves chlorination followed by adequate filtration. Low pH water can be treated with soda ash. Other iron-removal treatments include green sand filter, water softener, aeration and settling, pressure aeration and filtration, and polyphosphate treatment. However, these methods are not effective in removing high concentrations manganese. (Purdin-NWWA)
W80-05676

5D. Waste Treatment Processes

A FACILITY DESIGNED TO MONITOR THE UNSATURATED ZONE DURING INFILTRATION OF TERTIARY-TREATED SEWAGE, LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
R. C. Prill, E. T. Oaksford, and J. E. Potorti.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-102700, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-48, 1979. 14 p, 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Monitoring, *Unsaturated flow, *Infiltration, *Tertiary treatment, *Sewage treatment, Waste water treatment, Artificial recharge, Reclaimed water, Water analysis, Instrumentation, Soil moisture, New York, *Long Island(NY), *Suffolk County(NY), *Aquifer management.

A facility consisting of a circular recharge basin 6.10 meters in diameter with a central observation manhole was developed on Long Island, N.Y., to study the role of the unsaturated zone during aquifer recharge with tertiary-treated sewage. The manhole extends through most of the 7.5-meter-thick unsaturated zone, which is composed of glacial outwash sand and gravel, and enables collection of water samples and monitoring of dynamic characteristics of the unsaturated zone during recharge experiments. The system contains instrumentation for monitoring infiltration rate, pressure-head distribution, soil-moisture content, groundwater levels, and soil gases. The 24.55-square-meter recharge basin has operated in all seasons intermittently since April 1975 and, as of April 1978, has transmitted 62 million liters of tertiary-treated effluent to the water-table aquifer. Overall performance of the facility indicates that it is suitably designed for monitoring the unsaturated zone during artificial-recharge experiments. (Kosco-USGS)
W80-05444

MECHANISTIC AND PRACTICAL ASPECTS OF PHOSPHORUS REMOVAL FROM WASTEWATER USING IRON(III) SALT,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
M. A. Slam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-192362, Price codes: A08 in paper copy, A01 in microfiche. MS Thesis, May 1980. 151 p, 15 Fig, 83 Tab, 26 Ref. OWRT-A-052-NJ(2), 14-34-0001-9032.

Descriptors: *Phosphorus, Phosphates, Treatment, *Waste water treatment, *Phosphorus removal, Iron, Chemical precipitation, Nutrients, Sewage treatment.

Phosphorus removal was evaluated at several points in a conventional wastewater treatment process. Samples were taken from a secondary plant utilizing a high rate trickling filter on municipal wastewater. Treatment of settled primary effluent, secondary effluent and settled secondary effluent was considered. The experimental matrix included ferric ion dosage and pH level. Sampling points were selected to highlight process variables of interest. These included organic carbon content and unsettled solids content. In all cases, phosphorus removal was substantially less than predicted from pure species solubility data. In addition, the effect of unsettled or unsettleable solids is marked. In all experiments, comparisons of removal efficiency were made for filtered and unfiltered por-

tions of process samples. Beyond the obvious effects of cation dosage and pH, the nature and concentration of particulate matter appear to be important treatment variables. (Ahlert-NJ)
W80-05470

DESIGN AND SELECTION OF SMALL WASTEWATER TREATMENT SYSTEMS,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
S. A. Ross, P. H. M. Guo, and B. E. Jank.
Economics and Technical Review Report No EPS 3-WP-80-3, March 1980. 310 p, 71 Fig, 31 Tab, 87 Ref, 2 Append.

Descriptors: *Waste water treatment, *Sewage, *Analysis, Septic tanks, Cesspools, Domestic wastes, Sewage disposal, Sewage treatment, Waste treatment, Activated sludge, Chemical degradation, Environmental sanitation, Sanitary engineering, Sewage lagoons.

General information on the design and selection of waste water systems with capacities for populations up to 2500 is presented for use as a guide by those with limited experience in waste water treatment. Included is an outline of the steps and procedures to be used when selecting a design for a particular community. The grassroots of process design and selection is waste water characterization, which requires a monitoring program to provide information on flow variations, waste loading fluctuations, and treatment efficiency and flexibility. Various methods of on-site treatment and disposal are considered including septic tanks, aerobic tanks, tile fields, leaching cesspools, earth pit privies, vault-privies, compost toilets, chemical toilets, incinerator toilets, and others. Facilities at central waste water treatment systems are reviewed and classified on a functional basis into the categories of: flow equalization, solids removal, biological treatment, physical-chemical treatment, sludge treatment and disposal, and disinfection. Also reviewed are effluent disposal alternatives, small waste water collection systems, and regulatory agency requirements and the approval process. Procedures for the selection of small waste water treatment systems are discussed and illustrated with a case history of the Provincial Park Treatment Facility in Glen County, Ontario. A glossary of waste water treatment terms is also given. (Seigler-IPA)
W80-05564

TOXICITY OF LANDFILL LEACHATES,
Babichuk Construction Ltd., Calgary (Alberta).
For primary bibliographic entry see Field 5A.
W80-05654

5E. Ultimate Disposal Of Wastes

HYDROLOGIC ENVIRONMENT OF THE SILURIAN SALT DEPOSITS IN PARTS OF MICHIGAN, OHIO, AND NEW YORK,
Geological Survey, Columbus, OH. Water Resources Div.
S. E. Norris.
Geological Survey open-file report 78-684, June 1978. 31 p, 11 Fig, 24 Ref.

Descriptors: *Hydrology, *Environment, *Salts, *Connate water, *Groundwater movement, Michigan, Ohio, New York, Aggregates, Inorganic compounds, Sedimentary rocks, Folds(Geologic), Faults(Geologic), Brines, Permeability, Aquifers, Path of pollutants, Waste disposal, *Silurian salt deposits.

The aggregate thickness of evaporites (salt, gypsum, and anhydrite) in the Silurian Salina sequence in Michigan exceeds 1200 feet in areas near the periphery of the Michigan basin, where the salt beds are less than 3000 feet below land surface. In northeast Ohio the aggregate thickness of salt beds is as much as 200 feet in places, and in western New York it is more than 500 feet, where the beds are less than 3000 feet deep. The salt-bearing rocks dip regionally on the order of 50 feet per mile, those in Michigan dip toward the center of the State and those in Ohio and New York dip generally southward. The rocks in both basins thicken downdip. Minor folds and faults occur in the salt-bearing rocks in all three States. Some of this deformation has been attenuated by the salt beds. The salt beds are near the middle of thick sedimentary sequences, and are bounded above and below by beds containing water having dissolved solids concentrations several times that of seawater. The brines occur commonly in discrete zones of high permeability at specific places in the stratigraphic sequence. In each aquifer there is a vertical component of hydraulic head but little brine probably moves through the salt beds because of their very low permeability. Two areas in Michigan and one area each in Ohio and New York appear suitable for additional investigation of the properties and characteristics of the salt beds and their suitability as a disposal medium for radioactive wastes. One of the Michigan areas is in the northern part of the southern peninsula, in Presque Isle and Alpena Counties; the other is in the southern peninsula, in Oakland, Macomb, and St. Clair Counties. In northeast Ohio the area that appears to be suitable for investigation includes most of the eastern half of Lake County and extends eastward into Ashtabula County and southward into Geauga County. In western New York conditions warrant additional investigation in Schuyler, Tompkins, and western Cortland Counties. (Kosco-USGS)
W80-05443

GEOLOGIC MIGRATION POTENTIALS OF TECHNETIUM-99 AND NEPTUNIUM-237,
Oak Ridge National Lab., TN.
E. A. Bondietti, and C. W. Francis.
Science, Vol 203, No 4387, p 1337-1340, March 20, 1979. 1 Fig, 15 Ref.

Descriptors: *Migration, *Radioisotopes, *Radioactive waste disposal, Oxidation-reduction potential, Ground water, Solubility, Oxidation, Chemical reactions, Hazards, Trace elements.

The potential for long-lived radio-nuclides, Tc99 and Np237, to migrate from high-level radioactive waste repositories is evaluated. Under the oxidation-reduction conditions of ground water, relatively mobile Tc04- and Np02- are reduced to less soluble oxidation states in igneous rocks. Thus, current risk assessments, which consider technetium and neptunium as potentially capable of migrating to the surface if a waste repository is breached by water, may be overestimating their potential hazard to the public. The Fe(II) content of many subsurface waters may maintain these elements in less soluble oxidation states. The degree to which geologic media will influence the chemical state of the migrating elements will be determined by the reactivity of the rocks, the geologic contact time, and the degree of weathering (including oxidation) of the fracture surfaces through which migration occurs. (Purdin-NWWA)
W80-05446

ANALYSIS, CRITIQUE, AND REEVALUATION OF HIGH-LEVEL WASTE REPOSITORY WATER INTRUSION SCENARIO STUDIES,
Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
B. L. Cohen.
Nuclear Technology, Vol 48, No 1, p 63-69, April, 1980. 3 Tab, 21 Ref.

Descriptors: *Radioactive waste disposal, *Underground waste disposal, *Infiltration, Leaching, Laboratory tests, Geochemistry, Soil chemistry, Adsorption, Ground water movement, Fractures(Geologic), Sealants, Failures, Water pollution, Risks, Estimating, Radioactivity effects.

There have been several scenario studies of ground water intrusion into high-level radioactive waste repositories. All these studies assume that water intrudes after 100 to 1000 years, that wastes are leached and completely dissolved after a few thousand years, and that this ground water reaches the surface after 100 to 400 years, while the wastes migrate more slowly due to adsorption. The results of these studies are similar and can be easily understood in terms of the total number of cancers per unit of energy generated. However, these studies are over-conservative in estimating the time before water intrusion, leach rates are based on unrealistic laboratory experiments, and geochemical considerations in both leaching and ground water transport have been ignored. An alternative evaluation is proposed based on the assumption that radioactive material is leached at the same rate as rock material. This rate can be estimated from the chemical composition of the rock and ground water, and ground water flow rate. The result (excluding uranium 238) is 0.0008 eventual cancer/GW (electric)-yr. However, in the event of heat-induced rock fractures or failures of borehole and shaft seals, the only protection would be in the time required for leaching. (Purdin-NWWA)
W80-05556

MIGRATORY PROPERTIES OF SOME NUCLEAR WASTE ELEMENTS IN GEOLOGIC MEDIA,
Argonne National Lab., IL.
M. G. Seitz, P. G. Rickert, S. Fried, A. M. Friedman, and M. J. Steindler.
Nuclear Technology, Vo 44, No 7, p 284-296, July, 1979. 2 Fig, 6 Tab, 12 Ref, 1 Append.

Descriptors: *Migration, *Radioisotopes, *Radioactive waste disposal, Laboratory tests, Adsorption, Infiltration rates, Lysimeters, Trace elements, Chemical reactions, Ground water movement, Hazards.

This paper describes migration behavior of radionuclides in aqueous solutions with rocks from formations that may be suitable for waste repositories. Static adsorption experiments using rock tablets and solutions containing radionuclides were performed to study nuclide exchange. Silicate and carbonate tablets strongly adsorbed plutonium and americium. Thus, migration rates of these elements should be lower than the velocity of infiltrating water, and geologic media can be effective barriers to radionuclide migration in flowing water. Column infiltration experiments were performed with radioactive cesium, plutonium, neptunium, and americium. Peak concentrations moved slowly compared to the water. However, small quantities of the trace elements moved downstream from the peak activities due to the slow reaction rates or multiple speciation, colloid formation, movement of particles with adsorbed nuclides, or other causes. These fast-moving components may present a radiological hazard from a breached repository, even though they contain only a small fraction of the activity. Therefore, detailed characteristics of nuclide migration need to be considered in the design of a nuclear waste repository. (Purdin-NWWA)
W80-05661

5F. Water Treatment and Quality Alteration

THE SYNTHESES OF NITRATE AND NITRITE SELECTIVE POLYMERS,
Kansas State Univ., Manhattan. Dept. of Chemistry.
C. Shang-Jaw.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-195076, Price codes: A08 in paper copy, A01 in microfiche. PhD Dissertation, 1979. 159 p, 20 Fig, 10 Tab, 43 Ref. OWRT A-079-KAN(2).

Descriptors: *Polymers, *Water treatment, Nitrates, Nitrite, *Nutrient removal, Synthesis, Polyvinylbenzyl chloride, Nitron, Aqueous solutions, Commercial development.

The objective of the research reported in this thesis was to synthesize insoluble polymers to remove nitrate and nitrite from water. A high capacity nitrate- and nitrite-selective polymer was synthesized by attaching nitron to commercial polyvinylbenzyl chloride (60/40 ortho/para isomers). The capacity of this polymer to remove nitrate and nitrite from 10 minus to the third power M solution was 67% and 42%, respectively. In efforts to increase the nitrate capacity, another nitrate- and

nitrite-selective polymer was made using non-isomeric para-chloromethylpolystyrene as a supporting polymer backbone and attaching nitron to it. However, the capacity was found to be 65% which was about the same as using the polyvinylbenzyl chloride (60/40 o/p isomers) as the supporting polymer backbone. The compound 1-phenyl-2-diethylaminoethyl-4'-amino-benzoate was also synthesized and attached to commercial polyvinylbenzyl chloride. The nitrate and nitrite selectivity of this polymer was realized and the capacity of this polymer to remove nitrate and nitrite from aqueous solution was 76% and 65.5%, respectively. Another polymer was synthesized by attachment of 1-(4-nitrophenyl)-2-diethylaminoethyl-4"-hydroxybenzoate to polyvinylbenzyl chloride (60/40 o/p isomers). The capacity of this polymer to remove nitrate and nitrite from aqueous solution was 80% and 68%, respectively. All of the synthesized polymers could be easily regenerated without loss of capacity and use repeatedly providing a possibility for commercial development.
W80-05462

PRODUCTION OF TRIHALOMETHANES FROM THE CHLORINATION OF CAST IRON WATER PIPE BACTERIAL FILMS,
Missouri Univ.-Rolla. Dept. of Civil Engineering.
D. K. Muckerman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193394, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 63 p, 12 Fig, 10 Tab, 38 Ref. OWRT-A-108-MO(2), 14-34-0001-9027.

Descriptors: *Trihamethanes, *Bacteria, *Pipelines, *Chlorination, *Potable water, Haloforms, Trace organics, Bacterial films, Water distribution lines.

Trihalomethanes in drinking water are formed through the reaction between chlorine, which is used as a disinfectant, and trace quantities of organic precursors typically found in raw surface water. At this time, research concerning trihalomethanes has been restricted to areas pertaining to the formation and removal of these compounds during the water treatment process. This investigation studied the potential for the formation of trihalomethanes in a water distribution system with bacterial films acting as the organic precursor. One foot long cast iron pipe sections, coated on the inside with bacterial growth, were used to study the influence of chlorinated bacterial films on the production of trihalomethanes. The results of this study have shown that when a bacterial film was present there was more than a 500 percent increase in the production of total trihalomethanes as compared to when the bacterial film was absent. The increase in trihalomethane production resulting from the chlorination of bacterial films was also shown to be directly influenced by an increase in the initial chlorine dose, pH, and temperature. Bacterial films developed under anaerobic conditions were shown to produce 50 percent less trihalomethanes than aerobic films, but increasing the dissolved oxygen level from 1.4 mg/l to 5.0 mg/l resulted in only a 10 percent increase in trihalomethane production. The major trihalomethane specie resulting from the chlorination of bacterial films was the known carcinogen chloroform. (Jacquez-Mo)
W80-05469

WHAT DO YOU DO ABOUT GAS.
Canadian Water Well, Vol 6, No 2, p 18-19, May, 1980. 2 Fig.

Descriptors: *Methane, *Water wells, *Spraying, *Water tanks, Aeration, Cost, On-site tests, Performance, Clogging.

Methane gas can render a water well useless. Removal methods include various combinations of a sprayer nozzle system and a pressure tank in which the water passes under pressure through the series of sprayer nozzles and the gas is vented to the outdoors. Field tests of two methods were performed. One method used an aeration jet while the other used a vacuum pump. An explosion meter determined the amount of methane removed from the water. Both methods reduced the methane concentration to 1/20th of its initial concentration. The price of the aeration jet is much less than that of the vacuum pump. The total cost of the aerated system minus the well pump and a small pressure tank was $400. After two years of operation with no maintenance, the system was still effective in removing methane. A new aerator has been designed which will avoid plugging problems and produce much more air than the aeration jets. (Purdin-NWWA)
W80-05567

RUSTY MONSTERS--DISINFECTANT CONTROL OF IRON BACTERIAL INFESTATION,
Regina Water Research Inst. (Saskatchewan).
R. Cullimore.
Canadian Water Well, Vol 6, No 2, p 6,8,10, May, 1980. 2 Fig, 3 Tab.

Descriptors: *Iron bacteria, *Disinfection, *Water wells, Chlorination, Slime, Water temperature, Metabolism, Cytological studies, Detergents, Water pollution control.

Iron bacteria occur in open wells when sufficient iron and/or manganese is present along with organic or carbonate material. The level of concentration of chemical disinfectants needed to control iron bacterial infestations must be higher than those used to control bacteria in other places. Hypochlorite is ineffective at concentrations less than 500 ppm. Other than increasing concentration, the exposure time in the well can be prolonged to ensure complete disinfection. The higher resistance of iron bacteria is due to a thick slime layer around the cells which restricts the movement of disinfectants into the cell. In addition, the cells are layered with a coating of slime over each layer. Another problem in disinfecting a well is the low temperature of the well water which slows down the bacteria's metabolism and uptake of disinfectants. Iron bacteria begin to grow at about 5.7 degrees C and grow faster as temperature rises. Detergent/disinfectants may be more effective since they disperse the slime leaving the cells more vulnerable to disinfectant activity. An effective control must kill at least 99.9% of the iron bacteria within the well and attached to the well screen. Thus, physical method of control should also be examined. (Purdin-NWWA)
W80-05614

IRON AND MANGANESE CONTENT OF RURAL DOMESTIC WATER,
For primary bibliographic entry see Field 5C.
W80-05676

5G. Water Quality Control

ON THE NEED FOR A GREATLY EXPANDED EPA GROUNDWATER RESEARCH PROGRAM,
National Water Well Association, Worthington, OH.
J. H. Lehr.
Water Well Journal, Vol 18, No 3, p 206-210, May-June, 1980.

Descriptors: *Water pollution control, *Ground water, *Research priorities, Environmental Protection Agency, Research and development, Regulation, Surface water.

During the last decade, the EPA has focused its research and regulatory efforts on the control of surface-water pollution and virtually ignored ground-water pollution. Toward the end of the decade the EPA completed a Surface Impoundment Assessment in all 50 states which provided data for drafting necessary regulations and a basic ground-water education program among state environmental agencies. Simultaneously, the EPA's 208 Program was drafted giving equal emphasis to ground-water protection in waste-water management programs. During the past two years, a ground-water research strategy has been developed but progress has been slow due to lack of direction and funding from Congress. An expanded EPA research program aimed at ground-water protection should address nine major areas which include: training, information and technology transfer, technical assistance, sources of groundwater pollution, methods of detection, analytical procedures, transport and fate of pollutants, subsurface categorization, and aquifer rehabilitation. Needed research and action in each of these nine areas are described. (Purdin-NWWA)
W80-05543

SOIL MODIFICATION TO MINIMIZE MOVEMENT OF POLLUTANTS FROM SOLID WASTE OPERATIONS,
Arizona Univ., Tucson. Dept. of Soil, Water, and Engineering.
W. H. Fuller.
CRC Critical Reviews in Environmental Control, Vol 9, Issue 3, p 213-270, March, 1980. 25 Fig, 13 Tab, 1 Ref, 1 Append.

Descriptors: *Soil amendments, *Pollutants, *Leaching, *Landfills, Leachate, Solid wastes, Waste disposal, Heavy metals, Soil properties, Attenuation, Clays, Silts, Lime, Hydrogen ion concentration, Linings, Computer models, Model studies.

This paper examines practical, field-oriented ways in which soil may be modified to minimize movement of pollutants from solid waste operations. Although the nature of the leachate, as well as toxic components that must be controlled, play a critical role in migration, this paper focuses on soil aspects. Principal soil factors are identified and the movement of trace metals in soils is described as a statistical function of specific properties of the soil medium. The necessity of characterizing the three main site-disposal environments as to (1) soil, (2) leaching solution, and (3) specific polluting constituent is also discussed. Prominent soil parameters influencing attenuation components are (1) clay content, (2) silt content, (3) presence of lime, (4) pH level, and (5) presence of hydrous oxides of Fe, Mn, and Al. With these and other known parameters, certain soil modifications and low-cost liners for disposal sites are suggested. All sites require modification if migration of pollutants is to be retarded and prevented from reaching underground water sources or entering the food chain. Several attempts have been made to predict migration rates of toxic waste components by simulation models. The practical use of such models must be reviewed, though it appears that this technology is only in the very early stages of development. (Purdin-NWWA)
W80-05545

HYDROGEOLOGIC CONSIDERATIONS OF LANDFILL SITING AND DESIGN,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol 34, No 3, p 43-45, March, 1980. 3 Fig.

Descriptors: *Hydrogeology, *Design, *Landfills, *Sites, Topography, Water table, Permeability, Clays, Silts, Infiltration, Surface waters, Runoff, Diversion structures, Ground water barriers, Vegetation, Evapotranspiration, Slurry trenches, Grout curtains, Bottom seals, Linings, Drains, Dewatering, Leachate, Pumping.

In order to minimize and control ground and surface water pollution resulting from landfill leachate percolating into the subsurface environment, the local hydrogeology must be examined during site selection. Factors to be considered include: topography of the area surrounding a landfill; distance between the refuse and the top of the water table; and permeability and clay content of materials beneath the landfill. In addition, proper engineering design can control entry of surface water into the landfill, divert ground water around and under the landfill, control leachate plume migration or provide leachate treatment. Surface water infiltration can be reduced by: increasing runoff from the landfill by grading; decreasing runoff onto the landfill by constructing diversion ditches and ter-

races; applying a low permeability cover; and planting vegetation to increase transpiration. Barriers made of low permeability materials are used to divert or reduce ground water flow. These include slurry trenches, grout curtains, and bottom seals. Subsurface drains or dewatering systems manipulate the water table to prevent formation of leachate or contain its spread. In some cases leachate can be recaptured by pumping a well or a line of wells. (Purdin-NWWA)
W80-05546

GROUND WATER: A NATIONAL STRATEGY,
Environmental Research and Technology, Inc., Concord, MA.
For primary bibliographic entry see Field 6E.
W80-05551

OPEN OCEAN POLLUTION RESPONSE – THE COAST GUARD SYSTEM,
C. B. Doherty, C. A. Gauvin, R. A. Marcolini, and J. L. Obrien.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Volume 1, p 245-253, 1980. 7 Fig, OTC-3703. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Oil spills, *Oil pollution, *Water pollution control, Pollution control, Barriers, Equipment, Hazards, Environmental effects, Resources development, *Outer Continental Shelf, Skimmers, Petroleum development, Blowouts.

The Coast Guard has long recognized the need for a systems approach to open ocean pollution response. At the time of the IXTOC I blowout and the Burmah Agate spill, a series of at sea handing tests of pollution response equipment had been completed and more were scheduled. This paper describes the Coast Guard's integrated system approach, operational test results, and actual performance during the IXTOC I blowout and Burmah Agate responses. The performance of the Coast Guard skimming barrier at these pollution incidents is highlighted along with an analysis of lessons learned and future work needed. (Sinha-OEIS)
W80-05576

SPECTRAL WAVE FORECAST ANALYSIS AND OPERATIONAL EVALUATION FOR OFFSHORE LABRADOR OIL EXPLORATION,
For primary bibliographic entry see Field 5C.
W80-05580

DEEP OCEAN MINING POLLUTION MITIGATION,
Texas A and M Univ., College Station.
J. E. Flipse.
In: Proceedings of Twelfth Annual Offshore Technology Conference, held in Houston, TX, May 5-8, 1980. Vol 3, p 353-357, 1980. 2 Fig, 3 Ref. OTC-3834. Offshore Technology Conference, Dallas, Texas.

Descriptors: *Mining, *Water pollution control, *Pollution abatement, *Benthos, Resources development, Hazards, Damages, Environmental effects, Path of pollutants, *Outer Continental Shelf, Deep ocean mining.

During the investigation of possible financial penalties of deep ocean mining pollution mitigation, the major threats to the marine environment were identified and means to minimize damage proposed. This paper defines the major threats: the benthic plume of suspended particulate matter comprised of macerated marine biota and disturbed seabed sediments, and the surface plume of ingested benthic matter and abraded manganese nodule. Techniques for minimizing the disturbance of the seabed and limiting ingestion of benthic material in the dredge pipe and means for controlling the surface plume to limit possible damage to the euphotic zone of the water column are developed. The author concludes by recommending that the industry test and the scientific community evaluate the effectiveness of the proposed pollution mitigation approaches. (Sinha-OEIS)
W80-05582

MANURE SPILLS MAY BE THREAT TO WATER SUPPLIES.
For primary bibliographic entry see Field 5B.
W80-05624

THE PREVENTION OF POLLUTION OF THE MARINE ENVIRONMENT ARISING FROM OFFSHORE MINING AND DRILLING,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 6E.
W80-05682

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OPERATIONAL AERIAL SNOW SURVEYING IN THE UNITED STATES,
National Weather Service, Silver Spring, MD.
For primary bibliographic entry see Field 2C.
W80-05435

REVISION OF THE DOCUMENTATION FOR A MODEL FOR CALCULATING EFFECTS OF LIQUID WASTE DISPOSAL IN DEEP SALINE AQUIFERS.
INTERA Environmental Consultants, Inc., Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-122542, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water Resources Investigations 79-96, July 1979. 73 p, 1 Tab, 4 Ref.

Descriptors: *Computer models, *Model studies, *Waste disposal, *Aquifer characteristics, Saline water, Deep wells, Aquifers, Industrial wastes, Water pollution control, Groundwater movement, Equations, Mass transfer, Path of pollutants, *Deep-well waste-disposal model.

Details of additions and modifications to a computer code described in an earlier report 'A model for calculating effects of liquid waste disposal in deep saline aquifers,' USGS WRI 76-61, NTIS-PB256 903/AS are documented. These additions and modifications include free water surface, vertical recharge, equilibrium controlled linear adsorption and a first order irreversible rate reaction. These, plus additional modifications, make this model more adaptable to general hydrologic problems and those involving waste disposal with simple chemical reactions. (Kosco-USGS)
W80-05437

HYDROLOGY,
Missouri Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 7C.
W80-05461

GRAVITY GEOPHYSICAL DELINEATION OF BURIED CHANNEL AQUIFERS IN THE DISSECTED TILL PLAINS OF NORTHERN MISSOURI,
Missouri Univ.-Columbia. Dept of Geology.
M. D. Hall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-194343, Price codes: A06 in paper copy, A01 in microfiche. Master of Arts Thesis, December 1979. 95 p, 32 Fig, 26 Ref. OWRT A-112-MO(2), USDI OWRT 14-34-0001-9027.

Descriptors: *Buried river valleys, *Aquifers, *Geophysical exploration, *Missouri, Iowa, *Exploration, Maps, Topography, Bedrock, Gravity profiles, Geophysics.

Several methods of gravity geophysics, in conjunction with drift thickness and bedrock topography maps, were used to map the location of buried river valleys in northwestern Missouri. Drift thickness varies from zero to over 100 metres within the selected study area. The buried valleys are often filled with thick sequences of glacial-fluvial deposits which can serve as important aquifers. Over 900 gravimeter readings established a grid network over the study area. Two methods were used to calculate the regional Bouguer free-air anomaly: (1) polynomial trend surfaces of the reduced gravity readings and (2) trend surfaces defined by well data. The fifth-order polynomial trend surface closely matched the fifth-order surface defined by the well data. This indicates that the fifth-order polynomial trend surface closely matches basement rock topography in this area. This trend surface, along with the gravity residual and drift thickness maps, can be used to delineate these valleys with fair accuracy. Gravity profiles were run normal to several suspected buried valleys. The gravity residual profiles showed a strong correlation to bedrock topography, where known, and to several theoretical models. Gravity profiling can be used to delineate the deepest portion of these valleys. In all cases, an adequate density contrast was observed between the drift and the bedrock. Several promising branch aquifers, previously unreported, are indicated.
W80-05463

PRELIMINARY ESTIMATE OF REGIONAL EFFECTIVE GROUNDWATER RECHARGE RATES IN OHIO,
Ohio State Univ., Columbus. Dept. of Geology and Mineralogy.
For primary bibliographic entry see Field 2F.
W80-05466

STOCHASTIC FORECASTING OF MINE WATER INRUSHES,
Mining Development Inst., Budapest (Hungary).
I. Bogardi, L. Duckstein, A. Schmieder, and F. Szidarovszky.
Advances in Water Resources, Vol 3, No 1, p 3-8, March 1980. 6 Fig, 24 Ref. NSF INT78-12184.

Descriptors: *Forecasting, *Stochastic processes, *Mining, *Mine water, *Karst, Inflow, Hazards, Flooding, Flood forecasting, Warning systems, Model studies, Fissures(Geologic), *Hungary.

An event-based stochastic forecasting approach was used to model water inrushes into underground works under karstic water hazard. The stochastic properties of inrushes are related to the statistical properties of fissures in the karstic rock. The probability distributions (DF) of five random variables of interest in design were estimated; namely, inrush yield q, number N of inrushes per unit area, distance L between inrushes, maximum q sub max in N events, and total yield Q. The phenomenological hypotheses of log normal DF of q and Poisson DF of N were reinforced by observation data. On the basis of these DF, a Monte Carlo simulation of a spatial Poisson process of inrushes was run to estimate the DF of q sub max and Q. The derivation of Bayesian DF to account for parameter uncertainty was discussed. The stochastic model was used for design and operation of mine water control facilities in the Transdanubian karstic region of Hungary. (Visocky-ISWS)
W80-05477

BRUCEWOOD URBAN TEST CATCHMENT.
MacLaren (James F.) Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 2E.
W80-05566

A SEISMOTECTONIC ANALYSIS OF THE SEISMIC AND VOLCANIC HAZARDS IN THE PRIBILOF ISLANDS-EASTERN ALEUTIAN ISLANDS REGION OF THE BERING SEA,
Lamont-Doherty Geological Observatory, Palisades, NY.
J. N. Davies, and K. H. Jacob.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 2-92, October 1979. 39 Fig, 3 Tab, 62 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assess-

ment Program, Boulder, Colorado. NOAA-03-5-022-70.

Descriptors: *Hazards, *Seismology, *Volcanoes, *Earthquakes, Environmental effects, Resources development, Baseline studies, Exploration, Alaska, *Outer Continental Shelf, Petroleum development, Bering Sea, Pribilof Islands.

The general goal of this study is to monitor seismic and volcanic activity over a long time span and to evaluate this activity in terms of the hazard it implies for the exploration for and possible development of petroleum resources in the vicinity of the Shumagin Islands and Dutch Harbor regions of the eastern Aleutian Island Arc and western Alaska Peninsula regions, and of the Pribil of Islands region of the southeast Bering Sea. The relevance of this work to petroleum development is straightforward: The basic problem is to design structures that will withstand expected earthquakes, associated tsunamis, and volcanic activity within an acceptable level of risk. This design problem requires, as inputs, knowledge of the probable space-time distribution of large earthquakes, the accelerations vs. distances relations for those earthquakes and the distance to which various volcanic eruptions can be expected to be destructive. Specification of the minimum safe distance from a given volcano requires knowledge of the type of eruption to be expected and the frequency of eruption. The data being collected are essential to each of the above prerequisites to the inputs for the problem of designing safe and economica structures. (Sinha-OEIS)
W80-05583

EARTHQUAKE ACTIVITY AND GROUND SHAKING IN AND ALONG THE EASTERN GULF OF ALASKA,
Geological Survey, Menlo Park, CA. Office of Earthquake Studies.
C. Stephens, and J. C. Lahr.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 323-365, October 1979. 10 Fig, 1 Tab, 21 Ref, 4 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Hazards, *Earthquakes, *Seismology, Earthquake engineering, Design, Water pollution sources, Baseline studies, Environmental effects, Resources development, Alaska, Oil pollution, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

The objective of this research was to analyze the earthquake activity in the Northeast Gulf of Alaska (NEGOA) and adjacent onshore areas in order to develop a better model for the current tectonic framework. This information is critical to the establishment of criteria for the safe development of oil and gas. The eastern Gulf of Alaska and the adjacent onshore areas are undergoing compressional deformation caused by north-northwestward migration of the Pacific plate with respect to the North American plate. Short-period seismograph stations were installed along the eastern Gulf of Alaska. Single-component stations record the vertical component of the ground motion, while three-component stations have instruments to measure north-south and east-west motion as well. Data from these instruments are used to determine the parameters of earthquakes as small as magnitude 1. The parameters of interest are epicenter, depth, magnitude, and focal mechanism. These data are required to further understanding of the regional tectonics and to identify active faults. A network of strong motion instruments is also operated. These devices are designed to trigger during large earthquakes and give high-quality records of large ground motions which are necessary for engineering design purposes. (Sinha-OEIS)
W80-05588

SEISMIC AND VOLCANIC RISK STUDIES - WESTERN GULF OF ALASKA,
Alaska Univ., Fairbanks. Geophysical Inst.
H. Pulpan, and J. Kienle.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol IX, Hazards, p 424-492, October 1979. 22 Fig, 4 Tab, 41 Ref, Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-55.

Descriptors: *Hazards, *Earthquakes, *Volcanoes, Resources development, Drilling, Exploration, Water pollution sources, Environmental effects, Oil wells, Alaska, Monitoring, Forecasting, *Outer Continental Shelf, Alaska Peninsula, Gulf of Alaska, Petroleum development.

The objectives of this research are to evaluate geologic hazards to offshore petroleum development due to earthquake and volcanic activity in the lower Cook Inlet, Kodiak Island, Shelikof Strait and Alaska Peninsula offshore and onshore areas. Seismicity studies, based on both historic data and data accumulated from the operation of a high resolution seismic netowrk, provide some important input into quantitative seismic risk studies. The greatest seismic risk is associated with the shallow seismic thrust zone of the subducting Pacific plate. There is a high probability that a great earthquake will occur in the Shumagin gap within the lifetime of any potential petroleum development in that area. Seismic risk appears lower in the other offshore areas which do not overlie the shallow subduction thrust zone, but the risk is still primarily associated with the subduction process. Augustine volcano with its very active recent eruptive history presents perhaps the greatest volcanic risk within the lower Cook Inlet and Shelikof Strait lease areas. Based on its eruptive history in this century Augustine can be expected again to erupt within the lifetime of potential petroleum development in lower Cook Inlet. Having monitored the volcano for 9 years through its last major eruptive cycle in 1976, chances are enhanced of perhaps predicting the next one through careful geophysical monitoring. (Sinha-OEIS)
W80-05590

SEISMOTECTONIC STUDIES OF NORTHERN AND WESTERN ALASKA,
Alaska Univ., Fairbanks, Geophysical Inst.
N. N. Biswas, and L. Gedney.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 155-208, October 1979. 11 Fig, 4 Tab, 29 Ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-033-55.

Descriptors: *Seismic studies, *Tectonics, *Earthquakes, *Alaska, *Hazards, Baseline studies, Resources development, Exploration, Construction, Water pollution sources, Environmental effects, *Outer Continental Shelf, Petroleum development, Environmental assessment.

This study evaluates the extent of seismic hazards posed by earthquakes in northern and western Alaska. The consideration of all available seismic data for the Arctic region shows that the earthquakes do not distribute randomly in space but tend to concentrate along zones which were reactivated in the geologic past. The modern seismicity of the Canadian coast and its continuation through Barter Island in northeast Alaska and then along the thrust zone of the Brooks Range has been interpreted as an active regional intraplate tectonic zone. The reactivation of this zone continues to the present. The dense clustering of earthquakes around the Kobuk trench and Porcupine fault indicates that these two structures are active. Thus, linear structures, like pipelines, used for transportation of oil and gas through the eastern part of Brooks Range and Chandalar and Yukon River basins should take into account the possibility of ground dislocations, perhaps by a significant amount over a period of time, at points of mapped fault crossings. In the western part of Alaska, around the Seward Peninsula, analysis of the data gathered to date indicates a higher level of seismicity than was recognized prior to this study. To establish this finding within desirable bound of precision will require a data base which can only be obtained by the operation of a localized, high-resolution seismographic network for a reasonable length of time. (Sinha-OEIS)
W80-05599

6B. Evaluation Process

WATERSHED IMPACTS OF RECREATIONAL DEVELOPMENT IN GUADALUPE MOUNTAINS NATIONAL PARK, TEXAS,
Texas Tech Univ., Lubbock.
E. B. Fish, M. J. Dvoracek, V. B. Ackerson, B. L. Allen, and G. L. Brothers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-191547, Price codes: A99 in paper copy, A01 in microfiche. Texas Water Resources Institute, Texas A and M University, College Station Technical Completion Report, February 1980, 617 p, 170 Fig, 154 Tab, 219 Ref, 15 Append. OWRT B-206-TEX(2), 14-34-0001-7189.

Descriptors: *Recreation facilities, *Construction, *Environmental effects, *Watersheds(Basins), Planning, Evaluation, Recreational impacts, Water quality, hydrology, Streamflow, Texas, *Guadalupe Mountains National Park(TX).

In the southwestern United States, there is widespread concern about the hydrologic effects of a rapidly increasing population and the consequent drastic changes in the types and intensity of land use. This research effort was directed towards obtaining a data base consisting of climatic, vegetative, soil, erosional and hydrologic information which would be useful in the management decision making process for Guadalupe Mountains National Park, Texas. Based on initial studies five watersheds ranging in size from 25.32 square miles to 0.15 square miles were selected for intensive studies to quantify relationships between soil, vegetation, climatic, topographic, and geologic factors in such a way that they may be used as a basis for predicting the effects of modification in land use on erosion, water yield and quality, flooding and ground water supplies. Recommendations resulting from this project include: development of programs to establish appropriate recreational carrying capacities based on biophysical impacts on resource systems as well as sociological carrying capacity aspects; consideration of the highly erodible nature of most soils found in the park in the design criteria for trails and other facilities; continued monitoring of erosion transects on current roads and trails to further evaluate the erosion potential of soils found in the park; continued monitoring of water quality parameters with special emphasis on the McKittrick Canyon stream in the vicinity of the Pratt Lodge cesspool; development of plans for an improved waste disposal system in South McKittrick Canyon; continued monitoring of surface runoff phenomena and characteristics to refine predictions and establish explicit relationships for runoff phenomena.
W80-05410

FUTURE PROSPECTS FOR GEOTHERMAL ENERGY,
H. C. H. Armstead.
Physics in Technology, Vol 11, No 1, p 2-7, January, 1980. 4 Fig, 7 Ref.

Descriptors: *Geothermal studies, *Technology, *Future planning(Projected), Hot dry rocks, Deep heat mining, Fracturing, Economic feasibility, Drilling, Melting, Subterrene.

Approximately .25% of the world's present energy needs are supplied by earth heat. Present technology limits commercial exploitation to hyperthermal fields for power generation; semi-thermal fields for space heating, agriculture and industrial purposes; and deep aquifers in non-thermal areas for heating of homes and greenhouses. Future technology could open up new sources of earth heat for commercial exploitation. Hot dry rock exploitation is likely to be achieved in areas of

abnormally high temperature gradient and in non-thermal areas (deep heat mining). Hot dry rock exploitation is technically feasible but is not yet economic. The quanitity and grade of attainable heat, and the well depth depend on the degree of rock fracturing and the the temperature gradient. The mechanics of two-dimensional and three-dimensional rock fracturing are briefly discussed. For deep heat mining new drilling methods must be developed that will allow deep penetration at low cost. The most promising method is the melt-drilling 'subterrene' since the cost per foot decreases with depth due to the fact that rock temperature increases with depth and no steel casings are installed as the melted rock forms a tough vitreous lining. Cooling of the earth's crust due to deep heat mining may result in shrinkage. (Purdin-NWWA)
W80-05660

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE ROLE OF BENEFIT TAXATION AND COST SHARING IN NONPOINT POLLUTION MANAGEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
W. M. Park.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193089, Price codes: A10 in paper copy, A01 in microfiche. Ph.D. Dissertation, March 1980. 214 p, 19 Fig, 38 Tab, 68 Ref, Append. OWRT-A-085-VA(1).

Descriptors: *Water pollution control, *Nonpoint pollution management, *Benefit taxation, *Cost sharing, Water supply, Water storage, Water demand, Water distribution(Applied), Virginia, Northern Virginia, Occoquan River Basin(VA), Economic incentive mechanisms.

Although nonpoint pollution control strategies by 208 agencies have proceeded, implementation by local jurisdictions is not assured. Acceptance of a multijurisdictional control strategy requires each jurisdiction to receive non-negative net benefits. However, the control strategy which maximizes net benefits to the area need not distribute costs and benefits such that the criterion for acceptance is met. The primary thesis of this study is that, where local compensation is not considered, distributional factors are likely to constrain the set of acceptable control strategies developed in 208 planning, such that potential net benefits are foregone. The overall objective of the research was to investigate how specific economic-incentive mechanisms providing interjurisdictional compensation can be used to make net-benefit-maximizing nonpoint pollution control strategies acceptable. Northern Virginia's Occoquan River Basin 208 planning was used to illustrate the potential problem of acceptance. The linear programming model used for empirical analysis of nonpoint pollution control strategies for the Occoquan Basin provided for maximization of net benefits subject to certain constraints. Under benefit scenarios where a significant level of nonpoint control could be justified, the primary thesis of the study was supported. Compensation mechanisms involving beneficiary taxation and cost-sharing for implementation of nonpoint control measures which could make the net-benefit-maximizing control strategy acceptable were identified. Specific benefit taxation mechanisms were suggested.
W80-05471

EQUITY AND ECONOMICS IN SETTING WATER RATES FOR APARTMENT COMPLEXES,
West Virginia Univ., Morgantown. Regional Research Inst.
P. C. Mann.
Journal of the American Water Works Association, Vol 72, No 2, p 74-77, February 1980. 3 Fig, 7 Ref, West Virginia University Reprint Series VII, No 20.

Descriptors: *Water rates, *Water users, *Water demand, Water utilization, Domestic water, Cost sharing, Specific costs, Water costs, Economics, Cost comparisons, Load distribution, Peak loads, Industrial water.

Multiple minimum billing for water rates in apartment complexes is examined in terms of equity, effect on the water utility, the apartment owner, the apartment tenants, and its relationship to the rates assessed residential and commercial customer classes. Multiple minimum billing is a charge for water service where more than one premise is served through one master meter where (1) a minimum charge for each premise is based on the meter size that would be required for that premise, and (2) the average consumption for each premise for each billing period is the total use on the master meter divided by the number of apartments. Multiple minimum billing is a reasonable compromise between the metering of individual apartment units which is costly, and master or single point metering of the apartment complex which results in water rates that may be too low for the use pattern of the apartments. Many argue that apartment complexes are large volume users similar to commercial users and therefore should get the lower rates, however, apartment complexes have usage patterns similar to single-family residential units. This usage pattern or load factor is economically justified only by higher rates. Three recent cases concerning water pricing for apartment complexes are cited and it is concluded that there is economic justification for similar treatment of apartment complexes and residential users in the design of rate schedules. (Seigler-IPA)
W80-05562

A TALE OF TWO WELL SYSTEMS.
For primary bibliographic entry see Field 3D.
W80-05700

6D. Water Demand

CONGRESSIONAL QUANTIFIATION OF INDIAN RESERVED WATER RIGHTS: A DEFINITIVE SOLUTION OR A MIRAGE,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 6E.
W80-05697

NAVAJO WATER RIGHTS: PULLING THE PLUG ON THE COLORADO RIVER,
Department of the Interior, Washington, DC. Office of the Solicitor.
For primary bibliographic entry see Field 6E.
W80-05698

RECENT DEVELOPMENTS IN THE NORTHWEST REGARDING INDIAN WATER RIGHTS,
For primary bibliographic entry see Field 6E.
W80-05699

6E. Water Law and Institutions

WHEN IS A STREAM A STREAM. SOME GEOMORPHIC, HYDROLOGIC AND LEGAL CONSIDERATIONS,
Montana Univ., Missoula. School of Forestry.
J. S. Rankin, and G. T. Foggin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-204365, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Report No 104, Bozeman, 1980. 43 p, 6 Fig, 2 Tab, 75 Ref. OWRT A-115-MONT(1), 14-34-0001-0128.

Descriptors: *Water law, *Streams, *Channels, *Perennial streams, *Non-perennial streams, Hydrologic aspects, Legal aspects, Geomorphology, *Montana statutes, Case law, Common law, Water courses, Geohydrology, Stream networks, Stream order.

Recent litigation indicates that an ambiguity exists over what constitutes a stream under Montana's Natural Streambed and Land Preservation Act of 1975. A review of the relevant geomorphic, hydrologic, and legal literature indicates that the definition of 'stream' within Western water law has been consistent with the basic principles of the water sciences. Western water law tends to be liberal in favor of holding that running bodies of surface waters confined within reasonably definable banks and bed are to be considered streams, even if their flow is not continual. Additional attributes for a formal definition of stream would include several, but not necessarily all of the following: (1) a permanent source which contributes discharge waters at least periodically; (2) an outlet into another stream or other body of water; (3) at least periodic flow at times when other recognized streams in the area are flowing; and (4) regular or periodic service or potential for service similar to those in the vicinity. Short of a ruling by the Montana Supreme Court, it is recommended that either the offending definition be deleted from the Act and reliance be placed upon the established body of Western water law, or that a new and more comprehensive definition be substituted.
W80-05405

WILD RIVER MANAGEMENT: THE USE ALLOCATION ISSUE,
Montana Univ., Missoula. School of Forestry.
J. Utter, S. F. McCool, and W. Gleason.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-194830, Price codes: A07 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Montana State University, Report No 103, Bozeman, 1980. 117 p, 6 Fig, 14 Tab, 89 Ref, 2 Append. OWRT A-103-MONT(1), 14-34-0001-0128.

Descriptors: *Rivers, *Recreation demand, *Carrying capacity, *Wild rivers, *Water management(Applied), Administration, Legal aspects, Surveys, Statistical methods, River floating, Commercial user, Non-commercial user, User conflicts, Allocation techniques, Lottery, Rationing, Advance registration.

Among the most significant issues confronting managers of the nation's major wild or backcountry rivers is the allocation of float trip use under stringent use limit policies and relatively high demand. The study focused primarily on identification of significant legal and administrative information relevant to the Middle Fork of the Salmon River as well as on assessment of user's preferences for allocation techniques. Commercial users, noncommercial users, and rejectees (i.e., users who submitted applications to the Forest Service for a noncommercial float trip, but were rejected in the permit lottery) were asked on a self-administered questionnaire to rate two sets of allocation techniques. These pertained to (1) 'allotment' (the question of how to divide limited use between the commercial and noncommercial sectors of the user public), and (2) 'rationing' (the question of how to distribute permits for noncommercial float trip opportunities). The allotment technique most preferred by the commercial users was that currently in effect on the Middle Fork, while the noncommercial users and rejectees favored an 'Even-pool' technique. Least preferred by all three groups was 'Test River.' The most acceptable rationing technique to the commercial users was 'Advance Reservation;' for the noncommercial users and rejectees it was 'Lottery.'
W80-05409

THE ENFORCEMENT OF CONSISTENCY IN HAWAIIAN WATER RIGHTS: AN INTRODUCTION TO ROBINSON V. ARIYOSHI,
Hawaii Univ., Honolulu. Water Resources Research Center.
B. C. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193782, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 120, June 1978. 24 p. OWRT A-074-HI(1), 14-34-0001-8013.

Descriptors: *Water law, *Water rights, *Federal jurisdiction, *State jurisdiction, Legal aspects, Judicial decisions, Litigation, Hawaii, McBryde v. Robinson, Robinson v. Ariyoshi.

One of the most critical questions regarding the future of water regulation in Hawaii is the validity of the Hawaii Supreme Court's decision in the landmark case of McBryde Sugar Co. v. Robinson. In that case, the state court overturned the assumption that surface waters in Hawaii could be privately owned. To the parties involved in the litigation, the decision came as a surprise and upset the basis for their claims to waters of the stream. As a result, the parties sought to have the results of the state supreme court decision nullified in federal court. Their efforts were successful, and in October 1977, the federal district court voided the state supreme court decision. This article challenges the validity of the federal court's decision. The question presented before the federal court was a novel and unique one. The article discusses three models for resolving the problem and discusses an important distinction between the function of courts in declaring law and enforcing their judgments.
W80-05513

STATE WATER RESOURCE PLANNING AND POLICY IN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
M. M. Hufschmidt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-194236, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Institute, University of North Carolina, Raleigh, Report No UNC-WRRI-79-143, February 1980. 134 p, 7 Fig, 7 Tab, 36 Ref, 2 Append. OWRT B-103-NC(1).

Descriptors: *North Carolina, *Planning, *Future planning(Projected), Administrative agencies, Water resources development, Water quality, State governments, Federal government, Flood control, Sedimentation, Management, Optimum development plans, Land use.

North Carolina State water resource planning activities were studied over a two year period to develop an improved stategy for future water resource planning that includes changes in organization and adminstration, program content, and methodology. Following a brief historical review of activities in the 1965-1975 period, current resource management is analyzed in terms of the legislative base and program content of activities, the organizational structure of planning and management, and the connection between State and Federal programs and activities. Study results reveal that North Carolina's water management program is undergoing a transition, but has yet to reflect the appropriate balance between water quantity and quality. Federal Government pressures for water pollution control continue to take away from other important problems and needs. More State leadership is needed along with more effective mobilization of existing State resources such as those currently diffused in the Department of Natural Resources and Community Development and Human Resources. The most important unresolved problem is that of water quality management, including the allocation of water among competing resources. Other pressing areas include interstate water management, flood management, sedimentation control, and conservation. Recommendations are given on organization, programs, and planning including methodology and procedures. (Seigler-IPA)
W80-05516

ON THE NEED FOR A GREATLY EXPANDED EPA GROUNDWATER RESEARCH PROGRAM,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5G.
W80-05543

GROUND WATER: A NATIONAL STRATEGY,
Environmental Research and Technology, Inc., Concord, MA.
M. R. Deland.
Environmental Science and Technology, Vol 14, No 5, p 517, May, 1980.

Descriptors: *Water pollution control, *Legislation, *Ground water, Surface water, Air pollution, Waste disposal, Landfills, Regulations, Federal jurisdiction, Environmental protection agency.

There is no specific federal statute to protect ground water from pollution. Air and water pollution control statutes encourage land disposal of wastes which hasten contamination of ground water supplies. EPA estimates that 1700 billion gallons of liquid waste is discharged into the ground each year. In addition, only 6000 of the 16,000 landfills in this county operate under state permits and are assumed to be sanitary. Federal jurisdiction for the regulation of groundwater currently lies in a confusing hodgepodge of statutes which include the Clean Water Act, the Safe Drinking Water Act, the Resource Conservation Recovery Act, and the Toxic Substances Control Act. Environmentalists assert that ground water standards comparable to surface water and air standards are needed and that non-degradation of groundwater can be easily achieved by isolating aquifer segments. The EPA Ground Water Policy Committee is developing a National Ground Water Strategy by focusing on four basic issues: the nature and extent of the problem; current planning and control programs and what existing legislation can be applied; the relationship between federal, state, and local efforts and how to best define respective roles; and information and resource gaps. Publication of a final strategy is expected by December, 1980. (Purdin-NWWA)
W80-05551

GROUND AND SURFACE WATER INTERACTION - LEGAL ASPECTS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 4B.
W80-05553

WETLANDS: DENIAL OF MARCO PERMITS FAILS TO RESOLVE THE DILEMMA,
L. J. Carter.
Science, Vol 192, No 4240, p 641-644, 1976. 1 Fig.

Descriptors: *Permits, *Dredging, *River and Harbors Act, *Wetlands, Florida, Regulation, Legal aspects, Water permits.

On 16 April 1976 the U.S. Army Corps of Engineers denied two dredge and fill permits requested by the Deltona Corporation for the next phase of its Marco Islands project in southwest Florida. Many of the lots to have been constructed have already been sold and, apparently, cannot be delivered. Deltona can be expected to try to show that the national interest does not require denial of the permits. (Steiner-Mass)
W80-05619

THE PREVENTION OF POLLUTION OF THE MARINE ENVIRONMENT ARISING FROM OFFSHORE MINING AND DRILLING,
McGill Univ., Montreal (Quebec).
A. L. C. de Mestral.
Harvard International Law Journal, Vol 20, No 3, p 469-518, Fall 1979.

Descriptors: *Mining, *Water pollution control, *Oil pollution, *Law of the sea, Drilling, Continental shelf, Oceans, International law, Water pollution sources, Marine biology, Offshore platforms, Environmental control.

Mining and drilling in the territorial sea and on the continental shelf have assumed enormous proportions throughout the world, especially for sources of hydrocarbons. With this industrial activity has come an ever-increasing risk of marine pollution. The extent to which international law addresses this environmental problem is an issue of considerable concern. International law may not be sufficiently adopted to the special issues posed by offshore mining and drilling. Relevant principles and instruments can be found at the bilateral, regional, and multilateral level with varying degrees of effectiveness in dealing with offshore pollution. Of particular importance is the contribution of the Third United Nations Conference on the Law of the Sea. Private efforts at resolving the issues of offshore pollution have also been employed. An example is the Offshore Pollution Liability Agreement entered into by sixteen companies active in the North Sea. International law should preclude states from using their territory without regard to the impact of such drilling and mining operations on the world's environment. (Wilson-Florida)
W80-05682

ACHIEVING FEDERALISM IN THE REGULATION OF COASTAL ENERGY FACILITY SITING,
R. Kanouse.
Ecology Law Quarterly, Vol 8, No 3, p 533-581, 1980.

Descriptors: *Land use, *Decision-making, *Power plants, *Sites, Federal government, State governments, Legislation, Adoption of practices, Regulation, Programs, Project planning, Coastal energy development.

The 1972 Federal Coastal Zone Management Act (CZMA) attempts to accommodate both federal and state policies on coastal zone management in a single regulatory program. The CZMA's consistency clause provides for review of federally supported or conducted development projects to minimize conflicts with state programs. A detailed analysis of the consistency clause and its implementation is provided. Although CZMA was designed to give the states a primary role in coastal management decision-making, CZMA in practice will not achieve this objective in coastal energy facility siting. Two dispute resolution models are examined upon which a replacement for the consistency clause could be based. The success of each model is assessed under five criteria - ability to achieve federalism, efficiency in resource allocation, efficacy in protecting coastal resources, political feasibility and administrative workability. Congress should replace CZMA's consistency clause. Federal-state disputes should be resolved by a bargaining panel composed of representatives of the governmental and private interests. (Daniels-Florida)
W80-05683

ENVIRONMENTAL LAW: THE GROWTH AND EVOLUTION OF RIGHTS AND LIABILITIES,
Environmental Protection Agency, Chicago, IL.
T. F. Harrison.
Chicago-Kent Law Review, Vol 56, No 1, p 255-277, Winter 1980.

Descriptors: *Environmental control, *Shore protection, *Waste water disposal, *Water pollution control, *Judicial decisions, Legal aspects, Federal government, Federal jurisdiction, Water law, Federal water pollution control act, Administrative agencies.

Although few in number, the 1978-79 term decisions by the United States Court of Appeals for the Seventh Circuit in the area of environmental law dealt with a broad range of environmental issues. The strict liability provisions of section 311(b) (6) of the Federal Water Pollution Control Act, now the Clean Water Act, were upheld in two cases. Certain actions by the Army Corps of Engineers were upheld under section 111 of the 1968 Rivers and Harbors Act, which authorizes the Corps of Engineers to investigate, study and construct projects to prevent or mitigate shore damage attributable to federal navigation works. Citizens for a Better Environment v. Environmental Protection Agency (EPA) involved a challenge to the federal EPA administrator's approval of Illinois' program to administer the National Pollutant Discharge Elimination System (NPDES) within the state. The Court found the Illinois scheme deficient in that it failed to provide for adequate citizen participation. The Seventh Circuit also decided against the federal EPA administrator in a case involving the NPDES permit program. The viability of a common law nuisance action under the Clean Water Act was also confronted. (Wilson-Florida)
W80-05684

WATER CONSERVATION VS. PRIVATE WELLS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 3D.
W80-05685

LAW AND FOREIGN POLICY OF THE OCEANS,
Virginia Univ., Charlottesville.
J. N. Moore.
California Western International Law Journal, Vol 9, No 3, p 522-539, Summer 1979.

Descriptors: *Law of the Sea, *United States, *Political aspects, *Military aspects, Oceans, United Nations, Foreign countries, International law, International waters, Conferences, Marine fisheries.

Although every nation has an interest in the world's oceans, the United States (U.S.) has perhaps the largest stake. Defense and security needs are two of the specific stakes that the U.S. has in the oceans. Unlike the Soviet Union, the principle allies of the U.S. are located across the oceans. The U.S. is also very dependant on the merchant marine and the ability to use the oceans for trade. Forty percent of the global potential for hydrocarbons is located in the oceans. Other important U.S. interests in the freedom of the ocean includes living resources, manganese nodules, the environment, oceanographic research, and settlement of political disputes. Several significant trends that threaten these interests have developed in recent years. These include the substantial buildup of Soviet naval power, unilateral claims over certain ocean areas, and economic confrontations. The Third United Nation's Conference on the Law of the Sea is a study in compromises, but it is in the U.S. national interest to support it. (Wilson-Florida)
W80-05686

LOCAL-REGIONAL INTERACTION IN THE DEVELOPMENT OF COASTAL LAND-USE POLICIES: A CASE STUDY OF METROPOLITAN LOS ANGELES,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy.
R. Warren, L. F. Weschler, and M. S. Rosentraub.
Coastal Zone Management Journal, Vol 3, No 4, p 331-362, 1977. 2 Fig, 5 Tab.

Descriptors: *California, *Coastal plains, *Land use, *Shore protection, Rural areas, Preservation, Cities, Planning, Permits, Coasts, Local governments, Governmental interrelations.

Current efforts to create coastal management systems have emphasized the need to preserve rural and less developed areas. Because of this, too little attention has been given to problems of coastal resource management in large metropolitan regions. This study examines the coastal policies of local governments in the Los Angeles area before and after the passage of the California Coastal Conservation Act of 1972. The Act transferred control over coastal development from the city and county to the regional and state levels. It is argued that the very large socio-economic and political scale of a metropolitan region requires that local governments have a more direct role in planning and permit-granting processes than was possible under the 1972 Act. Nevertheless, it is concluded that the elimination of regional agencies and their dual function of focusing discussion and acting on certain aspects of coastal policy - as was done in the California Coastal Act of 1976 - may produce yet another set of problems for managing a metropolitan coastline. (Tabano-Florida)
W80-05687

LEGAL CONSIDERATIONS, INTERPRETATIONS AND PROJECTIONS OF MINUTE 242,
Secretaria de Relaciones Exteriores, Mexico City.
J. B. Lobato.
Natural Resources Journal, Vol 15, No 1, p 35-41, January 1975.

Descriptors: *Saline water, *United States, *Mexico, *Colorado River, International Bound. and Water Commission, Mexican water treaty, Treaties, Salinity, Legal aspects, International law, Water transfer.

The bilateral agreement between Mexico and the United States, contained in Minute 242 of the International Boundary and Water Commission, is the definitive and permanent solution to the salinity problem of the colorado River water sent to Mexico. Minute 242 is a completely obligatory executive agreement. The agreement interprets and clarifies certain terms of the 1944 Treaty. Definitive corrective measures are provided for situations when the tolerable degree of water salinity is exceeded. A compromise contained within the Minute limits the pumping of ground water in both countries' territories within five miles of the boundary between Sonora and Arizona. Both countries must come to an agreement concerning the use of ground water in the frontier use. A procedure of prior consultation was established as a means of avoiding future conflicts arising from any program which might adversely effect either country. The Minute incorporated the principle of use your own property so as not to injure that of another. (Daniels-Florida)
W80-05688

A FEDERAL AND REPRESENTATIVE STATE SYSTEM FOR PROTECTING RECREATIONAL AND SCENIC RIVERS,
Natural Resources Defense Council, New York.
E. Moss.
Earth Law Journal, Vol 2, No 1, p 83-94, February 1976.

Descriptors: *New York, *River regulation, *Wild rivers, *Recreation, Rivers, River flow, Federal government, River systems, Federal jurisdiction, Preservation, Appropriation, Water resources development.

River protection at the federal level and in the state of New York is discussed. The federal policy is established by the Wild and Scenic Rivers Act (Act), which preserves in free-flowing condition selected national rivers, and protects their immediate environments. The Act authorizes the appropriation of funds for the land acquisition in designated river areas, and also places restrictions on water resources projects which directly affect river areas of the system. Each river area must be classified, and studies done to determine if the area is suitable for inclusion in the system. New York has established a state system to accomplish many of the same purposes of the federal Act. Rivers are classified as wild, scenic, or recreational. Studies are done to determine inclusion and boundaries are set. Regulations for administration of river areas are set out. The state law also allows for inclusion in the national system, punishment for violators of the state law, and studies by other agencies and citizen groups to determine inclusion in the system. (Tabano-Florida)
W80-05689

FISHERIES: CANADA - UNITED STATES RECIPROCAL FISHERIES RELATIONS UNDER THE INTERIM FISHERIES AGREEMENT OF 1978,
J. T. Ball.
Case Western Reserve Journal of International Law, Vol 11, No 1, p 201-210, Winter 1979.

Descriptors: *Treaties, *Marine fisheries, *Canada, *United States, Negotiations, Jurisdiction, Fishing, Legislation, Fish management, International law, Boundaries(Surfaces).

On June 2, 1978, the Secretary of State for External Affairs of Canada released a statement concerning the difficulties encountered by the Canadian Government with enforcement of the 1978 Canada - United States (U.S.) Fisheries Agreement on both the Atlantic and Pacific Coasts. This provisional Interim Agreement was designed to sustain the traditional fishing rights of the two countries until a long-term pact could be worked out. The U.S. Department of State maintained that the effect of the Canadian Statement was that Canada no longer recognized the Interim Agreement, and that the U.S. would also repudiate it. The Interim Agreement was a natural outgrowth of the U.S. 1976 Fishery Conservation and Management Act. The most disputed area of the Interim Agreement involved salmon trolling in the American zone by Canadian vessels. Canada also viewed unrestricted U.S. fishing off the Gulf of Maine and the Georges Bank as excessive and unnecessary. Talks concerning all aspects of the dispute were to resume on June 19, 1978. (Wilson-Florida)
W80-05690

AIR AND WATER ACT ENFORCEMENT PROBLEMS - A CASE STUDY.
American Bar Association, Washington, DC. Committee on Environmental Controls.
The Business Lawyer, Vol 34, No 2, p 665-723, January 1979.

Descriptors: *Water pollution control, *Remedies, *Penalties(Legal), Administrative decisions, Environmental control, Legislation, Administrative agencies, Permits, Judicial decisions, Legal aspects, Decision making.

The Clean Air Act and the Clean Water Act created complicated and far-reaching environmental regulatory mechanisms. Presented is a panel discussion of the basic problems facing a corporate lawyer from beginning to end in the environmental enforcement process. The focus is on the central procedural and substantive questions involved in environmental law. The federal Environmental Protection Agency (EPA) has a large range of enforcement options. The enforcement mechanisms under each Act are similar, but important differences do exist. Amendments in 1977 made extensive changes in enforcement provisions. The EPA has the option, in civil enforcement, to go first to court or to issue an enforcement order. The considerations a lawyer would face under the administrative route are briefly explored. In court enforcement actions, questions about the weight given administrative actions and the possible defenses are reviewed. There are special problems concerning 'parties' in court enforcement actions. The prospects and theories of criminal enforcement are explored. Defenses and settlement considerations in both criminal and civil litigation are discussed. (Daniels-Florida)
W80-05691

COMPULSORY DISPUTE SETTLEMENT IN THE LAW OF THE SEA NEGOTIATIONS: A REASSESSMENT,
Virginia Univ., Charlottesville. School of Law.
J. P. A. Bernhardt.
Virginia Journal of International Law, Vol 19, No 1, p 69-105, Fall, 1978.

Descriptors: *Law of the Sea, *International law, *Negotiations, *Remedies, United Nations, Conferences, Foreign countries, Treaties, International commissions, Beds under water, Oceans.

The Resumed Seventh Session of the Third United Nations Conference on the Law of the Sea did not lead to any concrete, widely endorsed compromises on major issues. One of the obstacles to agreement is the compulsory dispute settlement regime under the Informal Composite Negotiating Text (Text). A candid reassessment should serve the goal desired by most states - the achievement of a comprehensive and compulsory dispute settlement system. The Text imposes basic obligations on parties to settle disputes. Parties may settle their disputes by means of their own choosing. If such means do not lead to a binding settlement, the parties may choose one or more of the following methods of settlement: the Law of the Sea Tribunal, the International Court of Justice, or arbitration. Disputes involving deep seabed mining must be submitted to a special panel. Ambiguity and inconsistency in the Text make the compulsory dispute settlement regime ineffective. Certain changes in the Text may serve to rectify these problems. (Wilson-Florida)
W80-05692

THE LONG ISLAND RESPONSE TO THE RISKS OF OUTER CONTINENTAL SHELF OIL PRODUCTION,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
L. E. Koppelman, and S. F. Robbins.
Coastal Zone Management Journal, Vol 7, No 2-3-4, p 163-183, 1980. 6 Fig, 10 Ref.

Descriptors: *Continental Shelf, *Local governments, *Oil industry, *Resources development, Environmental control, Administrative agencies, Coasts, Leases, Oil pollution, Legal aspects, Federal government, Shore protection, *Long Island(NY).

The dispute between Long Island and the Department of the Interior over proposals to explore and produce oil and gas off the Long Island coastline has resulted in a new strategy for strengthening environmental policy, the practice of American federalism and intergovernmental relations. Local governments have used a variety of legal and modeling techniques to elicit sufficient concessions from the federal government to mitigate the potential hazards of outer continental shelf (OCS) activities - particularly those that might impact directly on the coastal communities. In 1973, President Nixon directed the Secretary of the Interior to expedite lease sales of 10 million acres of OCS area for oil exploration. County executives on Long Island subsequently directed the Nassau-Suffolk Regional Planning Board to prepare technical studies and documentation to protect the Island's interests. In November, 1973, Long Island filed suit against the Interior Department. The legal battles, employed as a strategy to secure environmental safeguards identified in the technical studies, demonstrate the role of public opinion in shaping federal actions. (Wilson-Florida)
W80-05694

DEEP SEABED MINERAL RESOURCES ACT,
C. H. Johnston.
Natural Resources Journal, Vol 20, No 1, p 163-168, January 1980.

Descriptors: *Beds under water, *Resources development, *Oceans, *Mineral industry, Legislation, Mining, Energy, International waters, Regulation, Administrative agencies, Federal government.

The Deep Seabed Mineral Resources Act (Act) was unanimously approved by the Senate Energy Committee on May 1, 1979. The Act's purpose would be to promote the orderly development of hard mineral resources in the deep seabed, pending adoption of an international regime relating thereto. The Act would permit United States (U.S.) mining interests to begin commercial recovery of hard minerals from the ocean floor. The deep seabed is defined in the bill as 'the seabed, and the subsoil thereof to a depth of ten meters, lying seaward of and outside the continental shelf of any nation.' Under the proposed Act, the Administrator of the National Oceanic and Atmospheric Administration will regulate the mining activities and issue licenses to engage in exploration for the hard mineral resources. Provisions of the Act would be enforced by the Administrator. The Act would specifically disclaim any extraterritorial sovereignty, thereby protecting U.S. interests without disrupting delicate international negotiations concerning deep seabed exploitation. (Wilson-Florida)
W80-05695

CONGRESSIONAL QUANTIFIATION OF INDIAN RESERVED WATER RIGHTS: A DEFINITIVE SOLUTION OR A MIRAGE,
New Mexico Univ., Albuquerque.
C. DuMars, and H. Ingram.
Natural Resources Journal, Vol 20, No 1, p 17-43, January 1980.

Descriptors: *Water rights, *Reservation doctrine, *Indian reservations, *Water allocation(Policy), Legislation, Water users, Irrigation, Projects, Water supply, Colorado River Basin, Water conservation, Federal government.

Because most Indian water rights have never been quantified, planning future water use of developments in the west is risky. Indian reserved rights are generally prior to all other rights. As a result, all other water users are vulnerable until the exact magnitude of these rights is determined. One obvious way to reduce the ambiguity regarding western water rights is to negotiate with the Indian tribes, and, by an act of Congress, to quantify the precise amount of water to which the Indians are entitled. While this method is appealing, it does not necessarily work in practice, as illustrated by the Navajo Indian Irrigation Project (NIIP). The interests of society and the trust obligation of the federal government to the Indians are poorly served when the impetus for water quantification comes from pressures unrelated to the Indian's interest. NIIP also illustrates that water conservation is not necessarily a neutral activity that distributes benefits equally to all water users. The NIIP experience shows that unless congressional compromises are negotiated to truly reflect the interests of all parties, there is in fact no compromise. (Wilson-Florida)
W80-05697

NAVAJO WATER RIGHTS: PULLING THE PLUG ON THE COLORADO RIVER,
Department of the Interior, Washington, DC. Office of the Solicitor.
W. D. Back, and J. S. Taylor.
Natural Resources Journal, Vol 20, No 1, p 71-90, January 1980.

Descriptors: *Colorado River Basin, *Colorado River Compact, *Indian reservations, *Water rights, Federal reservations, Water demand, Water users, Treaties, Legislation, Water supply, Water resources development, Riparian rights.

Within the area drained by the Colorado River lies the 14 million acre Navajo Indian reservation, home of approximately 160,000 members of the Navajo Nation. Today, almost 80% of the homes on the reservation are without electricity or indoor water facilities. If Navajo 'Winters' rights are ever adjudicated, the potential needed water quantities are staggering. Potential development to a level commensurate with the rest of the country would require large diversions. Whether or not Navajo water rights are settled (quantified) by negotiation, litigation or other means, the decision-maker must analyze the Navajo right under the 'law of the river' - treaties, acts of Congress, judicial decisions and other relevant documents. The earliest of these is the Colorado River Compact, which does not affect the obligations of the United States to Indian tribes. Other similar instruments include the Upper Colorado River Basin Compact, the Colorado River Storage Project Act, and the 1968 Colorado River Basin Project Act. Western water users can no longer ignore the Navajo claim to its shore of water. (Wilson-Florida)
W80-05698

RECENT DEVELOPMENTS IN THE NORTHWEST REGARDING INDIAN WATER RIGHTS,
R. D. Dellwo.
Natural Resources Journal, Vol 20, No 1, p 101-120, January 1980.

Descriptors: *Water rights, *Indian reservations, *Reservation doctrine, *Water allocation(Policy), State jurisdiction, Legal aspects, Water users, Water law, Federal jurisdiction, Judicial decisions, Water demand.

Several recent Supreme Court decisions, and the judicial pattern that generated them, have totally changed the legal environment of pending Indian water right cases since early 1977. A substantial departure has been made from the 'Winters' doctrine of reserved rights for Indians. In Rosebud Sioux Trive v. Kneip, the Supreme Court reduced the territory of the Rosebud Sioux Reservation by 75% by stating that non-Indian portions of the reservation in both population and land ownership be disestablished. In Oliphant v. Suquomish Indian Tribe, the Court reversed favorable rulings of the lower courts regarding personal jurisdiction of Indian tribes. These and other cases have eroded tribal water rights in subsequent northwestern cases. While allowing state jurisdiction over permits or licenses to surplus waters on reservations, the courts will expand 'Winters' rights to include fisheries, recreation, commercial, and other uses reasonably needed by the tribe, even though those uses were not clearly conceived or intended when the reservations were established. (Wilson-Florida)
W80-05699

6G. Ecologic Impact Of Water Development

THE ROLE OF BENEFIT TAXATION AND COST SHARING IN NONPOINT POLLUTION MANAGEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W80-05471

HABITATS OF NATIVE FISHES IN THE SACRAMENTO RIVER BASIN,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
D. W. Alley, D. H. Dettman, H. W. Li, and P. B. Moyle.
In: Riparian Forests in California: Their Ecology and Conservation, Institute of Ecology Publication No 15, California University, Davis, p 87-94. May, 1977, 1 Tab, 28 Ref.

Descriptors: *Riparian waters, *Fish, *California, Habitat, Dams, Fish management, Wildlife habitat, Hydrology, Water temperature, Competition.

The assemblage of native freshwater fishes in the Sacramento drainage is typified by a relatively large number of endemic species and a large number of monotypic genera. In total there are 55 native species and 36 exotic species in the drainage area. The destruction of riparian forests in the Central Valley has been a small, but important, factor contributing to the changes in the fish communities, mostly because of the effect on water temperature. The most visible change in the drainage area has been the construction of dams for water storage, hydroelectricity, flood control, and groundwater recharge. These dams have had an effect on the fish fauna both upstream and downstream of the dam by altering hydrologic factors and increasing water temperatures. Results from interspecific competition studies indicate that changes in species composition below dams are not caused by competition between species for space. Patterns of abundance seemed to be determined by physical factors which affect physiological responses of fish which in turn may influence behavior. (See also W80-05606) (Steiner-Mass)
W80-05613

LONG-TERM EFFECTS OF MANIPULATING LIGHT INTENSITY AND NUTRIENT ENRICHMENT ON THE STRUCTURE OF A SALT MARSH DIATOM COMMUNITY,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-05621

7. RESOURCES DATA

7A. Network Design

WATER-RESOURCES INVESTIGATIONS IN GEORGIA, 1979.
Geological Survey, Doraville, GA. Water Resources Div.
Geological Survey Water-Resources Investigations in Georgia folder, 1979. 1 Sheet.

Descriptors: *Water resources, *Investigations, *Inter-agency cooperation, Surveys, Planning, Hydrologic data, Basic data collections, Streamflow, Runoff, Flood plains, Groundwater availability, Groundwater, Water quality, On-site investigations, Lakes, Reservoirs, Precipation(Atmospheric), Water level fluctu-

ations, Networks, Maps, Bibliographies, *U.S. Geological Survey, *Cooperative water-studies program.

Water-resources studies and investigations in Georgia made by the U.S. Geological Survey in cooperation with State and local agencies are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic-data network, areal hydrologic or interpretative studies, and research projects. The hydrologic-data network consists of primary, secondary, and water-management streamflow stations; ground-water observation wells; and water-quality observation sites. Small State maps show average annual precipation, flood-prone areas, principal sources of ground water, and discharge of principal rivers. A larger map shows hydrologic data stations and hydrologic investigations in Georgia as of January 1978. (Kosco-USGS)
W80-05450

7B. Data Acquisition

OPERATIONAL AERIAL SNOW SURVEYING IN THE UNITED STATES,
National Weather Service, Silver Spring, MD.
For primary bibliographic entry see Field 2C.
W80-05435

AERIAL GAMMA SURVEY OF SNOW COVER AND SOIL MOISTURE,
Gosgimet, Moscow (USSR).
M. V. Nikiforov, N. N. Pegoev, and A. N. Stroganov.
Hydrological Sciences Bulletin, Vol 25, No 1, p 85-91, March 1980. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Snow cover, *Soil moisture, *Remote sensing, *Gamma rays, Aircraft, Water equivalent, Moisture content, Mathematical models, Model studies, Snow, Snowmelt, Water resources, Precipitation(Atmospheric), Surveys, Snow surveys, Soil water, Measurement, Gamma-ray spectrometry.

The paper presented the general concepts of the gamma method of measuring snow cover and soil moisture, and considered the design of an airborne observation network for gamma surveys over large areas. Description of the equipment and measuring techniques used in the Soviet Union were given. Estimates of errors from various sources were presented, as well as results of comparisons between the aerial measurements and the direct ground measurements used as controls. (Sims-ISWS)
W80-05494

PRINCIPLE AND METHOD FOR MEASUREMENT OF SNOW WATER EQUIVALENT BY DETECTION OF NATURAL GAMMA RADIATION,
Institute for Atomenergi, Kjeller (Norway).
G. O. Endrestol.
Hydrological Sciences Bulletin, Vol 25, No 1, p 77-83, March 1980. 9 Ref.

Descriptors: *Snow, *Water equivalent, *Remote sensing, *Gamma rays, Methodology, Aircraft, Snow cover, Moisture content, Snow surveys, Snowmelt, Water resources, Precipitation(Atmospheric), Measurement, Gamma-ray spectrometry.

The principles of snow cover determination by use of terrestrial gamma radiation were presented. Several proposed methods of measurement were discussed, and some of the more important sources of error for these methods were listed. Finally the accuracies of the methods were estimated. (Sims-ISWS)
W80-05495

AIRCRAFT GAMMA-RAY SPECTROMETRY IN SNOW WATER EQUIVALENT MEASUREMENT,
National Water Board of Finland, Helsinki.
R. Kuittinen, and J. Vironmaki.
Hydrological Sciences Bulletin, Vol 25, No 1, p 63-75, March 1980. 5 Fig, 7 Tab, 8 Ref, 1 Append.

Descriptors: *Snow, *Water equivalent, *Remote sensing, *On-site investigations, Aircraft, Gamma rays, Snow cover, Snow surveys, Snowmelt, Water resources, Moisture content, Measurement, Precipitation(Atmospheric), Gamma-ray spectrometry.

During the winter of 1976-1977 and 1977-1978 the Hydrological Office at the National Board of Waters and the Geological Survey of Finland carried out a joint study to evaluate the usefulness of gamma-ray spectrometry in snow water equivalent measurement. A multichannel gamma-ray spectrometer was fitted in a DC-3 aircraft. Fourteen snow courses were operated using the gravimetric method and the gamma-ray method. The snow courses were located in southern Finland in forest, swamp, and agricultural land. The results showed that the gamma ray method can be considered suitable for use in Finnish conditions and that the accuracy of the gamma-ray method is almost as good as the accuracy of the gravimetric method. (Sims-ISWS)
W80-05496

ELECTRICAL RESISTIVITY OF GEOTHERMAL BRINES,
For primary bibliographic entry see Field 1B.
W80-05542

THE USE OF POINT DILUTION METHODS IN DETERMINING THE PERMEABILITIES OF LAND-FILL MATERIALS,
Birmingham Univ. (England). Dept. of Geological Sciences.
J. W. Lloyd, C. Ramanathan, and N. Pacey.
Water Services, Vol 83, No 1005, p 843-846, November, 1979. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Tracking techniques, *Permeability, *Landfills, *Dye dispersion, Tracers, Fluorescent dye, Path of pollutants, Movement, Leachate, Solid wastes, Analytical techniques, Ground water movement, Boreholes.

Determination of ground water flow in assessing landfill leachate migration requires accurate measurement of piezometer-tip geometry, ground water gradient and waste material permeability. Measurement of permeability by pumping tests or slug tests is difficult. Point dilution methods with tracers introduced into boreholes are simple and inexpensive to operate and give reliable results. The material permeability is determinable under the assumptions that homogeneous dilution velocities are present in a borehole open section and velocities in the borehole section are analogous to those in the aquifer. With these assumptions the decrease in tracer concentration is a direct function of ground water velocity and in turn permeability. In a study of point dilution tests in differing materials it was found that the ideal test configuration is a water-table condition with a borehole of 50-100 mm diameter containing a water volume of between 1000 and 3000 ml. The borehole should be open and adequately screened throughout the saturated section and should only penetrate one type of permeable material. Initial fluorescein concentrations in borehole water should be at about 20 mg/liter and the test should not exceed 5 days. (Purdin-NWWA)
W80-05554

REGIONAL AQUIFER PARAMETERS EVALUATED DURING MINE DEPRESSURIZATION IN THE ATHABASCA OIL SANDS, ALBERTA,
Northern Illinois Univ., DeKalb. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W80-05558

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES,
Alaska Univ., Fairbanks. Geophysical Inst.
A. E. Belon.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 253-321, October 1979. 14 Fig, 2 Append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado. NOAA-03-5-022-55.

Descriptors: *Data processing, *Remote sensing, *Satellites(Artificial), Monitoring, Data collections, Water pollution sources, Oil spills, Weather forecasting, Environments, Environmental effects, Alaska, *Outer Continental Shelf, Data management, Environmental assessment, Oil trajectories.

The outer continental shelf of Alaska is so vast and so varied that conventional techniques are unlikely to provide the detailed and comprehensive assessment of its environmental characteristics which is required before the development of its resources is allowed to proceed. The utilization of remote-sensing techniques, in conjunction with conventional techniques involves the combined analysis of ground-based (or sea-based), aircraft and satellite data by a technique known as multistage sampling. In this technique, detailed data acquired over relatively small areas by ground surveys or sea cruises are correlated with aerial and space photographs of the same areas. Then the satellite data, which extend over a much larger area and provide repetitive coverage, are used to extrapolate and update the results of the three-way correlations to the entire satellite photograph. Thus, maximum advantage is taken of the synoptic and repetitive view of the satellite to minimize the coverage and frequency of data which have to be obtained by conventional means. The morphology and dynamics of sea-ice which are relevant to navigation and construction of offshore structures, the patterns of sediment transport and sea-surface circulation which will aid to forecast trajectories of potential oil spills, the nature of ecosystems in the near-shore regions which can be changed by human activity, are among the critical development-related environmental parameters which are studied and eventually routinely monitored by remote-sensing. (Sinha-OEIS)
W80-05601

ANNUAL R VALUES IN NORTH MISSISSIPPI,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 2B.
W80-05636

PRELIMINARY MUSKEG (PEATLAND) INVENTORY OF THE PROVINCE OF NEW BRUNSWICK,
New Brunswick Dept. of Natural Resources, Fredericton.
E. A. Korpijaakko.
Canadian Journal of Earth Sciences, Vol 12, p 24-27, 1975. 3 Fig, 8 Ref.

Descriptors: *Distribution patterns, *Peat, Wetlands, *Bogs, Remote sensing, Mapping, Data processing, Computers, Canada, New Brunswick.

The distribution of peatland as a percentage of land area and the distribution of open and treed peatlands as percentages of peatland area have been determined for the Province of New Brunswick. For this work, aerial photographs, a dot planimeter, a mirror stereoscope and a computerized mapping procedure, SYMAP, in conjunction with the University of New Brunswick IGM system/360 computer were used. The results have been displayed in the form of symbolized computer printout maps (SYMAP) showing the distribution of peatland in New Brunswick. About 10% (about 700 000 ha) of the land area of New Brunswick is covered by peatland. (Steiner-Mass)
W80-05641

DETECTION AND MONITORING OF WATER HYACINTH (EICHHORNIA CRASSIPES) INFESTATION IN LAGUNA DE BAY THROUGH MULTISPECTRAL DIGITAL ANALYSIS OF LANDSAT IMAGERIES,

Natural Resource Management Center, Quezon City (Philippines).
R. T. Bina, R. Jara, E. Lorenzo, and B. de Jesus, Jr.
International Symposium on Remote Sensing of the Environment, Vol 12, p 1791-1798, 1978. 4 Fig, 1 Tab.

Descriptors: *Water hyacinth, *Census, *Remote sensing, Wetlands, Aquatic plants, Aquatic weeds, Satellites(Artificial), Distribution patterns, Management.

In an effort to determine the potential of LANDSAT data in the detection and monitoring of water hyacinth (Eichhornia crassipes) infestation in Laguna de Bay, the Natural Resources Management Center conducted initial studies to find out what information is obtainable from LANDSAT data, in preparation for LANDSAT C Program. Preliminary results indicate that a number of information vital in the management of water hyacinth infestation such as patterns of distribution, density estimates, area coverage, etc. can be obtained from LANDSAT data through visual and digital analysis using the Image 100 system. (Steiner-Mass)
W80-05659

THAILAND'S LITTORAL MUDFLATS AS INTERPRETED FROM LANDSAT IMAGERY,
Applied Scientific Research Corp., Bangkok (Thailand).
N. Sriplung.
International Symposium on Remote Sensing of the Environment, Vol 12, p 2045-2049, 1978. 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Mudflats, *Remote sensing, Wetlands, Satellites(Artificial), Mapping, Littoral, Intertidal areas, Aerial photography, Landsat imagery.

An investigation was conducted to determine the littoral and sublittoral mudflats of Thailand based on Landsat imagery. The interpreted map was verified by ground truth survey using cars, boats and helicopter. A combination scheme of diazochrome color composite transparencies was conceived which yields best results for mudflat identification. The study showed an area of 910 sq km and 3700 sq km for Thailand's littoral and sublittoral mudflats, respectively. (Steiner-Mass)
W80-05662

WETLAND CLASSIFICATION AND MAPPING IN WESTERN TENNESSEE,
Geological Survey, Reston, VA.
V. Carter, D. L. Malone, and J. H. Burbank.
Photogrammetric Engineering and Remote Sensing, Vol 45, No 3, p 273-284, March, 1979. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Remote sensing, *Wetlands, *Tennessee, Mapping, Aerial photography, Distribution patterns, Biogeography, Boundaries(Surfaces).

A wetland classification was developed for the Tennessee Valley Region based primarily on vegetation, and on frequency and duration of inundation. Using the classification system, wetlands at four sites were mapped at 1:24,000 scale as overlays on U.S.G.S. 7.5-minute topographic maps. Adjacent land use was also mapped, but in less detail than wetlands. The methodology for separating and delineating wetland classes was carefully documented. Overlays for separate dates were combined to make the final camera-ready composite overlay. A lithographed map of wetlands and land use was made for one of the five quadrangles covering the Reelfoot Lake site. At the Reelfoot and Hatchie River sites, the stage at time of photography was referenced to a stage-duration curve, placed on the map collar, to show that boundaries are representative of average water levels rather than extreme highs or lows. (Steiner-Mass)
W80-05664

SATELLITE STUDIES OF FRESH-WATER ICE MOVEMENT ON LAKE ERIE,
National Environmental Satellite Service, Washington, DC.
For primary bibliographic entry see Field 2C.
W80-05672

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1978--VOLUME 1. MISSOURI RIVER BASIN.
Geological Survey, Cheyenne, WY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-165152, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WY-78-1, January 1980. 652 p, 9 Fig.

Descriptors: *Wyoming, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Missouri River basin(Wyo).

Water resources data for the 1978 water year for Wyoming consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. Volume 1 of this report contains discharge records for 166 gaging stations; stage only records for 1 lake; stage and contents for 10 lakes and reservoirs; water quality for 125 gaging stations, 76 ungaged stations, 2 reservoirs, 113 wells and springs; and water levels for 36 observation wells. Also included are 76 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (Kosco-USGS)
W80-05438

WATER RESOURCES DATA FOR WYOMING, WATER YEAR 1978--VOLUME 2. GREEN RIVER BASIN, BEAR RIVER BASIN, AND SNAKE RIVER BASIN.
Geological Survey, Cheyenne, WY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-177587, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WY-78-2, 1980. 728 p, 6 Fig.

Descriptors: *Wyoming, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Green River basin(Wyo), *Bear River basin(Wyo), *Snake River basin(Wyo).

Water resources data for the 1978 water year for Wyoming consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of wells. Volume 2 of this report contains discharge records for 62 gaging stations; stage and contents for 5 lakes and reservoirs; water quality for 43 gaging stations, 19 ungaged stations, and 75 wells and springs; and water levels for 8 observation wells. Also included are 24 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Wyoming. (Kosco-USGS)
W80-05439

RIVER MILEAGES AND DRAINAGE AREAS FOR ILLINOIS STREAMS--VOLUME 1, ILLINOIS EXCEPT ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
R. W. Healy.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A082 472, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-110, 1979. 350 p, 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Rivers, *Drainage area, *Illinois, *Streams, *Tributaries, Watershed(Basins), Locating, Sites, Bridges, Dams, Gaging stations, Navigation, Mapping, Basic data collections, *River mileages, *Illinois except Illinois River basin.

River mileages are presented for points of interest on Illinois streams draining 10 square miles or more. Points of interest include bridges, dams, gaging stations, county lines, hydrologic unit boundaries, and major tributaries. Drainage areas are presented for selected sites, including total drainage area for any stream draining at least 100 square miles. (Kosco-USGS)
W80-05440

RIVER MILEAGES AND DRAINAGE AREAS FOR ILLINOIS STREAMS--VOLUME 2. ILLINOIS RIVER BASIN,
Geological Survey, Champaign, IL. Water Resources Div.
R. W. Healy.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A082 473, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-111, 1979. 302 p, 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Rivers, *Drainage area, *Illinois, *Streams, *Tributaries, Watersheds(Basins), Locating, Sites, Bridges, Dams, Gaging stations, Navigation, Mapping, Basic data collections, *River mileages, *Illinois River basin.

River mileages are presented for points of interest on Illinois streams draining 10 square miles or more. Points of interest include bridges, dams, gaging stations, county lines, hydrologic unit boundaries, and major tributaries. Drainage areas are presented for selected sites, including total drainage area for any stream draining at least 100 square miles. (Kosco-USGS)
W80-05441

THE U.S. GEOLOGICAL SURVEY IN ALASKA, 1979 PROGRAMS,
Geological Survey, Anchorage, AK. Water Resources Div.
Geological Survey Circular 804-A, 1979. 94 p, 22 Fig, 4 Tab. (Reed, K.M., editor).

Descriptors: *Alaska, *Projects, *Natural resources, *Research and development, Energy, Mineralogy, Topographic mapping, Geology, Water resources, Investigations, Conservation, Oil, *U.S. Geological Survey, *Outer Continental Shelf, National Petroleum Reserve in Alaska.

This circular describes the 1979 programs of the U.S. Geological Survey in Alaska. The mission of the Geological Survey is to identify the Nation's land, water, energy, and mineral resources; to classify federally-owned mineral lands and waterpower sites; to resolve the exploration and development of energy and natural resources on Federal and Indian lands; and to explore and appraise the petroleum potential of the National Petroleum Reserve in Alaska. Alaska is at once the largest, the least populated, the least explored, and the least developed State in the Nation. More than half of the Nation's 600 million acres of Outer Continental Shelf lies off Alaska's coast, and nearly half of the remaining 762 million acres of Federal land are within its borders. Its resources of all kinds present an opportunity to demonstrate how the needs of both conservation and development can be met for the benefit of the American people. (Kosco-USGS)
W80-05448

WATER-RESOURCES INVESTIGATIONS IN GEORGIA, 1979.
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W80-05450

HYDROLOGY,
Missouri Univ., Columbia. Dept. of Geology.
M. G. Foley.
Geotimes, Vol 25, No 2, p 30-31, February, 1980.

Descriptors: *Hydrologic systems, *Model studies, Hydrologic data, Stochastic processes, Synthetic hydrology, Parametric hydrology, Deterministic hydrology, Systems analysis, Statistical models, Dispersion.

Past hydrologic models have relied heavily on engineering hydraulics and geomorphological approaches, neither of which can predict dynamic consequences of system perturbations. When perturbations exceed some threshold, a new equilibrium state is established. Modeling of these phenomena suffers from lack of data. Current hydrologic models fall into 3 classes: deterministic, in which known physical principles and initial and boundary conditions allow accurate description of system behavior; stochastic, in which systems are assumed to have inherent randomness; and parametric, in which empirical relations among system variables may give some ability to predict system behavior. Data requirements for precise results from a deterministic model are overwhelming. However, a middle ground may exist between deterministic and parametric modeling in which data requirements are minimized by use of lumped parameters. Such quasi-deterministic modeling has been common in ground water modeling where some parameters may exhibit random behavior and are not subject to detailed analysis. Dispersion analyses indicate that dispersion cannot be treated as a normally distributed random process. Thus, there may be a limit to the modeler's ability to estimate limits of error. This uncertainty is critical in modeling of radioactive waste disposal, stream-channel management, and drainage basin response to human exploitation. (Purdin-NWWA)
W80-05461

USING MODELS TO SIMULATE THE MOVEMENT OF CONTAMINANTS THROUGH GROUND WATER FLOW SYSTEMS,
Wisconsin Univ., Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W80-05547

GROUNDWATER REGIME ASSOCIATED WITH SLOPE STABILITY IN CHAMPLAIN CLAY DEPOSITS,
Ecole Polytechnique, Montreal (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8D.
W80-05555

COMPARISONS OF FOUR METHODS FOR DETERMINATION OF DEGREE OF PEAT HUMIFICATION (DECOMPOSITION) WITH EMPHASIS ON THE VON POST METHOD,
Great Lakes Forest Research Centre, Sault Sainte Marie (Ontario).
For primary bibliographic entry see Field 2I.
W80-05649

LARGE-SCALE DEMONSTRATION OF AQUATIC PLANT MAPPING BY REMOTE SENSING,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
L. E. Link, and K. S. Long.
International Symposium on Remote Sensing of the Environment, Vol 12, p 907-915, 1978. 3 Fig, 1 Tab.

Descriptors: *Remote sensing, *Aquatic plants, *Mapping, Wetlands, Techniques, Model studies, Aerial photography, Radar, Satellites(Artificial), Submerged plants, Costs.

Remote sensor systems evaluated for mapping aquatic plant distributions were Landsat, high-altitude aerial photography, and side-looking radar. Results of field tests showed that Landsat imagery could be used effectively to depict areas with emergent of floating aquatic plants, if the areas are large enough to be resolved. Submerged plants could not be detected reliably. The easy availability of Landsat images, periodic coverage, and relatively low cost for pictoral products are definite advantages. The major disadvantage of the use of aerial photography is the relatively high cost and number of photos that have to be handled. Both surface and submerged plants can be effectively delineated and the spatial resolution is better than Landsat. Radar imagery can detect floating and emergent plants and allows all-weather imaging, day or night, but is usually unavailable, expensive, and cannot detect submerged vegetation. Model studies were conducted to determine the best aerial photographic systems for mapping aquatic vegetation. False-color infrared photography taken with a yellow filter and overexposed by one F-stop provides the best mapping tool of both surface and submerged plants. (Steiner-Mass)
W80-05655

8. ENGINEERING WORKS

8A. Structures

SIZING WATER WELL SYSTEMS FOR GROUND WATER HEAT PUMPS: PART I,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol 34, No 4, p 36-37, April, 1980. 2 Tab.

Descriptors: *Size, *Water wells, *Heat pumps, Water supply, Water demand, Water consumption, Domestic water, Well casings, Well screens, Design, Pumps, Water yield.

Proper sizing of a water system requires the following information: (1) average daily water consumption in the home: (2) peak demand usage of water in the home; (3) the ability of the aquifer to yield water to a well; and (4) the well yield. In calculating average daily water use, it is assumed that the water system supplies all domestic water needs. Water demand for a heat pump ranges from one to three gpm per 12,000 BTU. Simultaneous operation of several plumbing fixtures will produce a peak demand situation. Peak demand allowance for each fixture is about one-fourth its flow rate. Pump capacity should equal the sum of all peak demand allowances. Well design is a function of pump diameter and aquiferpermeability and thickness. Pump capacity must not exceed the well capacity or dewatering and pump damage will result. The well casing diameter should be one to four inches larger than the pump diameter. A well screen should allow water to enter the well at a rate low enough to avoid incrustation or corrosion. (See also W80-05460) (Purdin-NWWA)
W80-05459

SIZING WATER WELLS FOR GROUND WATER HEAT PUMPS: PART II,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol 34, No 5, p 36-37, May, 1980. 1 Fig.

Descriptors: *Size, *Water tanks, *Heat pumps, *Water storage, Water demand, Domestic water, Water supply, Pumps, Water reuse.

If well yield cannot meet peak demand, some type of water storage will be necessary. The well itself can provide some storage, especially if it is deep or has a large diameter. Most modern water supply systems use a pressure tank even if it is just to maintain adequate water pressure and reduce pump operation. Large buried tanks can provide storage for heat pump use. The sizing of these tanks varies considerably with climate and depends on the difference between well pump capacity and heat pump demand. If part of the stored water is diverted for domestic uses, the size must be increased accordingly. Storage requirements can be reduced by recycling some of the water leaving the heat pump back to the storage tank. (See also W80-05459) (Purdin-NWWA)
W80-05460

THE GHURA-DEDEDO DEEP MONITORING WELL: PLANNING AND DESIGN,
Guam Univ., Agana. Water Resources Research Center.
C. J. Huxel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-193824, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No 15, 1980. 15 p, 5 Fig, 6 Ref. OWRT A-008-GUAM(1), 14-34-0001-8012.

Descriptors: *Groundwater, *Monitoring, *Islands, Pacific Ocean, Saline water-fresh-water interfaces, *Deep wells, Design criteria, *Guam, *Micronesia, Mariana Islands.

The final design of Guam's first deep monitoring well has evolved from an open borehole concept through a three-well system and finally to the present one-well system. The one-well system utilizes an inflatable packer assembly which will permit the accomplishment of several goals: (1) Observation and simultaneous recording of point-water heads at 2 different levels. (2) Collection of water samples from isolated aquifer intervals. (3) Definition of a depth-salinity curve for the water column in the monitoring well. Although the one-well system is presently under construction, the design process is still continuing. A satisfactory method for emplacing and sealing the casing is still being worked out. Also, the precise location of the alternating perforated and sealed casing intervals must be determined.
W80-05540

HYDROGEOLOGIC CONSIDERATIONS OF LANDFILL SITING AND DESIGN,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5G.
W80-05546

GIANT HOLES ARE DRILLED IN NEVADA.
For primary bibliographic entry see Field 8H.
W80-05549

DEVELOPMENT OF HARDWARE AND PROCEDURES FOR IN-SITU MEASUREMENT OF CREEP IN SEA ICE,
Alaska Univ., Fairbanks. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W80-05592

THE APPLICATION OF PETROLEUM ENGINEERING TO GEOTHERMAL DEVELOPMENT,
Union Oil Co. of California, Los Angeles. Geothermal Div.
V. E. Suter.
Mining Engineering, Vol 32, No 1, p 43-47, January, 1980. 11 Ref.

Descriptors: *Geothermal studies, *Engineering, *Drilling, Reservoir operations, Well testing, Well stimulation, Secondary recovery, Injection wells, Drilling fluids, Cements, Drilling equipment, Corrosion, Scaling, Silica.

Similarities and differences between geothermal and petroleum operations are discussed. The higher temperatures and fluid flow rates of geothermal wells affect drilling equipment and methods. Improved methods of testing geothermal wells and a technique for creating artificial fractures in geothermal reservoirs need to be developed. Using petroleum reservoir engineering equations and measured parameters, reserves per acre can be calculated. Since about 98% of the reservoir heat is in the rock, water injection should be used to maintain pressure and extract additional

heat. High temperatures and depth require improved bits, high compressive strength cements, and a sepiolite-lignite drilling mud to reduce flocculation. The use of aerated water as a drilling fluid has been successful in combating lost circulation during drilling and cementing but this results in accelerated corrosion. Silica scale can cause clogging of injection pumps, lines and wells. It is estimated that by the year 2000 the United States will develop 20,000 MW of geothermal electric generating capacity. This will require at least 1000 exploratory wells and 6,000 development wells at a current cost of $800,000 per well. (Purdin-NWWA)
W80-05653

8B. Hydraulics

PERMEABILITY AND PIPING IN FRACTURED ROCKS,
California Univ., Berkeley. Dept. of Geological Engineering.
R. E. Goodman, and P. N. Sundaram.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol 106, No GT5, Proceedings Paper 15433, p 485-498, May 1980. 7 Fig, 2 Tab, 10 Ref, 1 Append.

Descriptors: *Permeability, *Fractures(Geologic), *Pipe flow, *Soils, Fracture permeability, Sediment transport, Soil water movement, Soil erosion, Laboratory tests, Particle size, Soil properties, Hydraulic properties, Groundwater movement, Dam failure, Piping.

Design criteria for compacted fine-grained soil placed against coarser material ensure protection of the soil from being eroded. However, not much attention has been paid to the problem of erosion and piping when compacted soil is placed against jointed rock. This paper reported the results of preliminary laboratory investigations to study the erosion of a compacted silty soil into rough or smooth fractures of a cylindrical rock specimen under radial flow conditions. The tests showed that erosion of soil particles and subsequent transport through the fractures are functions of fracture-aperture, pressure-difference causing flow, and size of soil particles. The largest dimension of the soil particles eroded generally increased with the pressure difference causing flow. Cycling of water pressure seems to have a pronounced effect on the erodibility and transport of soil particles. (Vicocky-ISWS)
W80-05431

PHYSICAL MODELING OF BUBBLE SCREENS,
Texas Univ. at Austin. Dept. of Civil Engineering.
S. Tekeli, and W. H. C. Maxwell.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol 106, No WW1, Proceedings Paper 15176, p 49-64, February 1980. 3 Fig, 14 Ref, 2 Append. NSF ENG76-24226.

Descriptors: *Aeration, *Screens, *Bubbles, Density, Dimensional analysis, Hydrodynamics, Reservoirs, Model studies, Hydraulics, Froude number, Mathematical models, Flow, Mixing, *Bubble screens.

Bubble screens have long been used for a variety of purposes, ranging from control of stratification, density currents, oil spills, shoaling, icing, and wave heights, to inducing artificial mixing for augmentation of convective heat and mass transfer rates, aeration and water quality control. Dimensional and similitude considerations have been employed to develop the necessary requirements for physical modeling of such screens. This led to the development of a set of scaling relationships into which a scale factor was introduced to account for distortion of similitude requirements. The scaling relationships were also found to depend on a densimetric Froude number representing source strength. These permit transposition of model results to field scale. (Lee-ISWS)
W80-05432

NUMERICAL MODELING OF TIDAL CIRCULATION IN HARBORS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W80-05433

BIOLOGICAL IMPACTS OF MINOR SHORELINE STRUCTURES ON THE COASTAL ENVIRONMENT: STATE OF THE ART REVIEW, VOLUME I,
Beak Consultants, Inc., Portland, OR.
E. L. Mulvihill, C. A. Francisco, J. B. Glad, K. B. Kaster, and R. E. Wilson.
Fish and Wildlife Service Biological Services Program Report No FWS/OBS-77/51, March 1980. Volume I of II, 163 p, 61 Fig. 14-16-0008-2153.

Descriptors: *Environmental effects, *Coastal structures, *Coastal engineering, *Shore protection, Bulkhead line, Jetties, Abutments, Breakwaters, Docks, Harbors, Levees, Piers, Piles(Foundations), Retaining walls, Sea walls, Data collections.

Information from 555 sources located in an information search was used to develop a computer data base for the analysis of the biological impacts of minor shoreline structures. Structures included were: breakwaters, jetties, groins, bulkheads, revetments, ramps, piers and other support structures, buoys and floating platforms, small craft harbors, bridges, and causeways. Data were compiled by type of structure and by coastal region including the following: structure functions; site characteristics; geographic prevalence; engineering, socioeconomic, and biological placement constraints; construction materials; expected life span; environmental conditions; methodology of impact studies; physical and biological impacts; and alternatives. Results show that structure impact on the environment is site-specific. Fourteen case history studies are included. Small boat harbors, bridges and causeways, bulkheads, breakwaters, and jetties were found to have the most potential for coastal environment impact. Revetments, groins, and ramps have moderate impact potential, while buoys and floating platforms, piers, and other support structures have low impact potentials. Little information relative to the potential impacts of bridges, causeways, and small boat harbors was identified. Also, very little information on the quantitative impacts of specific structures was located. Prepared from the data base and available in Volume II is a printout of the data base, an annotated bibliography, a keyword index, and a primary author reference number index. (See also W80-05474) (Seigler-IPA)
W80-05473

BIOLOGICAL IMPACTS OF MINOR SHORELINE STRUCTURES ON THE COASTAL ENVIRONMENT: STATE OF THE ART REVIEW, VOLUME II: DATA PRINTOUT,
Beak Consultants, Inc., Portland, OR.
E. L. Mulvihill, C. A. Francisco, J. B. Glad, K. B. Kaster, and R. E. Wilson.
Fish and Wildlife Service Biological Services Program Report No FWS/OBS-77/51, March 1980. Volume II of II, 313 p. 14-16-0008-2153.

Descriptors: *Data collections, *Environmental effects, *Coastal structures, *Shore protection, *Coastal engineering, Bulkhead line, Jetties, Abutments, Breakwaters, Docks, Harbors, Levees, Piers, Piles(Foundations), Retaining walls, Sea walls.

A data base printout, an annotated bibliography, a keyword index, and a primary author reference number index developed as part of an information search for the analysis of the biological impacts of minor shoreline structures are presented. Structures included in the study were: breakwaters, jetties, groins, bulkheads, revetments, ramps, piers and other support structures, buoys and floating platforms, small craft harbors, bridges, and causeways. Types of information contained in the data base include the following: local name of structure, function, prevalence in coastal region, geographic location, site characteristics, placement constraints, construction conditions, impact methodology, and research in progress. Information from this data base was used to develop the state of the art review found in Volume I. Overall results show that structure impact on the environment is site-specific, however, in general, small boat harbors, bridges and causeways, bulkheads, breakwaters, and jetties were found to have the most potential for coastal environment impact. Revetments, groins, and ramps have moderate impact potential, while bouys and floating platforms, piers, and other support structures have low impact potentials. (See also W80-05473) (Seigler-IPA)
W80-05474

SEEPAGE IN THE PARTIALLY SATURATED ZONE BENEATH TAILINGS IMPOUNDMENTS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 2F.
W80-05557

8C. Hydraulic Machinery

PHYSICAL MODELING OF BUBBLE SCREENS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W80-05432

SIZING WATER WELL SYSTEMS FOR GROUND WATER HEAT PUMPS: PART I,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8A.
W80-05459

SIZING WATER WELLS FOR GROUND WATER HEAT PUMPS: PART II,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 8A.
W80-05460

LINE-SHAFT AND SUBMERSIBLE SELECTION--SOME CONSIDERATIONS,
Engineered Products, Brampton (Ontario).
M. Bieman.
Canadian Water Well, Vol 6, No 2, p 24-26, May, 1980. 1 Fig, 1 Tab.

Descriptors: *Pumps, *Pump turbines, Selection, Design, Economics, Cost comparisons, Initial costs, Installation costs, Electric power demand.

The deep well turbine was developed to extract the maximum capacity from the minimum well diameter. The service conditions (pump location, well size and depth, accessibility, and head/capacity requirements) will usually indicate whether a submersible motor or line-shaft configuration will be more economical in the long run. Certain applications lend themselves strictly to either line-shaft design or submersible turbine design. However, most situations are not clear cut and selection should be based on the following considerations: well diameter, well depth, static water level, pumping water level, drawdown, head above datum, pump capacity, water composition, type of drive, and allowable motor overload. In applications where a choice must be made between line-shaft and submersible drives, manufacturer's charts for the pumps must be used to determine horsepower requirements. Next, the initial cost and installation costs should be considered. Submersible units have cheaper pumps but more expensive motors. Installation and freight costs for submersible units are about one quarter that of the line-shaft units. (Purdin-NWWA)
W80-05544

PROGRESS IN THE USE OF DRIP IRRIGATION,
Kassel Univ. (Germany, F.R.). Dept. of International Agriculture.

For primary bibliographic entry see Field 3F.
W80-05548

CORE DRILLS CAN BE IMPROVED,
Read Drilling and Development Corp., Washington, DC.
V. Read.
Drilling Contractor, Vol 36, No 4, p 38, 42-43, April, 1980.

Descriptors: *Core drilling, *Rotary drilling, *Drilling equipment, Mining, Exploration, Geothermal wells, Crystalline rocks, Penetration.

A new hybrid rotary/core drilling rig is designed for fast rotation with very precise hydraulic cylinder feed controls. Instead of a rotary table, it has a hydraulic power swivel capable of slow rotation at high torque or fast rotation at low torque. The drillhead is pushed down or pulled by a pair of hydraulic pistons set in the mast. This system allows 30 ft. of continuous core-drilling compared to 3 to 4 ft. with conventional diamond core drills. An air compressor and hydraulically powered water and foam/bentonite injection pumps are built into the rig. With a rotary percussion air hammer, penetration rates of 120 ft./hr. are possible in the hardest rocks. In hardrock geothermal drilling the mining air-drill can drill straight holes at an angle from the verticle to bottom a number of holes 30 to 40 acres apart. (Purdin-NWWA)
W80-05550

SUBMERSIBLE MOTORS...RELIABLE PERFORMANCE DEPENDS ON RELIABLE INSTALLATION,
Franklin Electric, Bluffton, IN. Submersible Engineering Dept.
K. D. George.
Water Well Journal, Vol 34, No 3, p 62-66, March, 1980. 5 Fig.

Descriptors: *Submersible pumps, *Installation, *Performance, *Electric motors, Reliability, Cooling, Thermal insulation, Lightning arrestors, Sand pumping, Corrosion, Incrustation, Cycles, Valves, Electric cables, Electrical grounding.

Installation guidelines are presented to ensure reliable performance of submersible pumps. Most submersible motors require a specified minimum flow rate for adequate cooling. If there is insufficient cooling, overloading, or a locked pump, thermal protection is required to prevent motor burnout or other damage. Proper grounding is essential to prevent shock hazard. If the motor lacks an internal lightning (surge) arrestor it should be protected with an above-ground arrestor. A well in a sandy area should be developed using another pump before installing the permanent submersible. Corrosive conditions require a motor with internal thermal protection against overheating from mineral deposits or the pump should be cleaned periodically. The pumping system should be designed to minimize cycling as much as possible to reduce stress and wear. Torque effects can cause pump and pipe problems if the installation is inadequate to resist the torque. Pumps should have a check valve or at least a leak-back-type valve installed less than 25 feet above the water level in the well. Proper type, size, and connection of the electrical supply cable and correct input voltage and frequency from the power supply are essential for efficient, reliable operation. (Purdin-NWWA)
W80-05559

LINESHAFT TURBINE PUMP SELECTION,
Jacuzzi Brothers, Inc., Little Rock, AR.
A. Swan.
Water Well Journal, Vol 34, No 3, p 60-61, March, 1980.

Descriptors: *Pump turbines, *Design, *Size, Impellers, Pumps, Water wells, Columns, Hydraulic equipment, Installation.

The efficiency of lineshaft turbine pumps depends on proper selection and installation. Proper selection requires data on well depth, casing diameter, pumping water level, required capacity, and pump discharge pressure. Proper bowl assembly selection requires a pump performance curve and data on well diameter, capacity characteristics of the bowl, and impeller design. Closed impellers should be used in installations with varying discharge pressures and in excess of 200 feet. The number of bowl stages required can be determined by dividing the total dynamic head by the largest diameter impeller head. Lineshaft size depends on pump speed, pump horsepower and total pump thrust. The outer column size depends on the pumping rate. Use of suction pipe and strainer of the same size as the outer column is recommended. The size and type discharge head selected depends on the outer column size, shaft size, driver base diameter and pump setting. Motor selection depends on the pump speed and horsepower. Headshaft and driver coupling bore size are usually the same as lineshaft size. If the driver doesn't have a non-reverse ratchet, a backspin timer and time delay relay must be used on the motor control to prevent damage during periods of reverse rotation. (Purdin-NWWA)
W80-05561

DRILLING BITS--ROTARY.
Canadian Water Well, Vol 6, No 2, p 22, May, 1980. 4 Fig.

Descriptors: *Rotary drilling, *Drilling bits, Design, Performance, Rocks, Water wells.

The choice of rotary drill bits in various types of drilling conditions should be based primarily on experience. However, general principals of bit selection and use should be followed. Thread size should be specified when ordering bits. Usually the first step is to drill down with the Kelly and a starter bit. Use of the correct bit for each type of drilling condition will result in faster penetration. For soft drilling a drag bit should be used but for harder drilling a heavy-duty insert bit can be used. If drilling becomes harder, a rock bit will be needed. Rock bits are made in six designs for soft rocks to extra hard rocks. If the material is too hard for the extra hard rock bit, the next step is the tungsten carbide button bit. Again there are several variations which progress in the same manner as rock bits. Industrial diamond bits are harder than carbide button bits. Both are expensive and rarely used by water well drillers. A percussion 'down hole hammer' bit is used in conjunction with a tool that is inserted down the hole and operated by air. It is expensive and used only for extremely hard materials. (Purdin-NWWA)
W80-05615

8D. Soil Mechanics

SOIL MODIFICATION TO MINIMIZE MOVEMENT OF POLLUTANTS FROM SOLID WASTE OPERATIONS,
Arizona Univ., Tucson. Dept. of Soil, Water, and Engineering.
For primary bibliographic entry see Field 5G.
W80-05545

GROUNDWATER REGIME ASSOCIATED WITH SLOPE STABILITY IN CHAMPLAIN CLAY DEPOSITS,
Ecole Polytechnique, Montreal (Quebec). Dept. of Civil Engineering.
J. LaFleur, and G. Lefebvre.
Canadian Geotechnical Journal, Vol 17, No 1, p 44-53, February, 1980. 9 Fig, 9 Ref.

Descriptors: *Slope stability, *Pore pressure, *Groundwater movement, *Clays, Effective stress, Finite-element analysis, Safety factors, Failures, Permeability, Flow nets, Aquifers, Anisotropy, Computer models, Canada.

In analyzing the stability of slopes consisting of Champlain clay in terms of effective stresses, it is generally assumed that flow occurs parallel to the slope or even that pore pressures are under hydrostatic conditions. However, due to the geologic environment of the Champlain clays, the pore-pressure distribution could deviate significantly from these simple assumptions. The influences of various geometric and stratigraphic factors on the pore-pressure distribution and slope stability was studied using a finite-element analysis. A parametric slope stability analysis translates the effect of pore-pressure distribution in terms of the variation of the factor of safety against failure. Field data from four sites in the St. Lawrence valley are presented in support of the theoretical findings. The stratigraphy and permeability measurements combined with the finite-element method enabled a complete flow net to be drawn from which the pore pressures could be adequately determined. (Purdin-NWWA)
W80-05555

DUNE DISTRICT MANAGEMENT: A FRAMEWORK FOR SHOREFRONT PROTECTION AND LAND USE CONTROL,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
For primary bibliographic entry see Field 2L.
W80-05693

8E. Rock Mechanics and Geology

HYDROGEOLOGY OF SEDIMENTARY ROCKS--CLASTICS,
For primary bibliographic entry see Field 2F.
W80-05617

8G. Materials

THE CORROSIVE WELL WATERS OF EGYPT'S WESTERN DESERT,
Geological Survey, Reston, VA. Water Resources Div.
F. E. Clarke.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $2.75. Geological Survey Water-Supply Paper 1757-0, 1979. 55 p, 34 Fig, 6 Tab, 27 Ref.

Descriptors: *Corrosion, *Water wells, *Groundwater, *Water quality, *Corrosion control, Acidic water, Chemical degradation, Well screens, Well casings, *Eggypts Western Desert.

The discovery that ground waters of Egypt's Western Desert are highly corrosive is lost in antiquity. Introduction of modern well-drilling techniques and replacement of native wood casing with steel during the 20th century increased corrosion problems and led to an intense search for causes and corrective treatments. Extreme corrosiveness results from combined effects of relatively acidic waters with significant concentrations of destructive sulfide ion; unfavorable ratios of sulfate and chloride to less aggressive ions; mineral equilibria and electrode potential which hinder formation of protective films; relative high chemical reaction rates, because of abnormal temperatures, and high surface velocities related to well design. There is general agreement that conventional corrosion control methods would be ineffective or impracticable. Thus, control must be sought through the use of materials more resistant to corrosion than plain carbon steel where well screens and casings are necessary. Of the alternatives considered, stainless steel appears to be the most promising where high strength and long-term services are required and the alloy's relatively high cost is acceptable. Epoxy resin-bounded fiberglass and wood appear to be practicable, relatively inexpensive alternatives for low-strength applications. Other materials such as hign strength aluminum have shown sufficient promise to merit their consideration in particular locations and uses. The limited experience with pumping in these desert wells leaves uncertainties concerning the durability of conventional pump designs. (Kosco-USGS)
W80-05447

THE FIELD EVALUATION OF A SYNTHETIC MATERIAL FOR USE AS A SLOPE PROTECTION METHOD ON IRRIGATION DAMS,

Missouri Univ.-Rolla. Dept of Civil Engineering.
D. L. Dutton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-192370, Price codes: A08 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 159 p, 65 Fig, 12 Tab, 81 Ref, 2 Append. OWRT-B-122-MO(1), 14-34-0001-8095.

Descriptors: *Evaluation, *Slope protection, *Irrigation dams, *Synthetic material, *Testing, *Strength of materials, Wave protection, Model studies, Field studies.

This report concerns the problem of slope protection on irrigation dams. A field study of a slope protection method utilizing a new synthetic fabric material in the form of soil filled bags has been conducted to determine the placement requirements and erosion resistance of the system. Laboratory testing has provided the strength data of the fabric after intervals of exposure to the environment as well as the fill retention characteristics of the fabric. The field study was performed to evaluate the feasibility of filling and placing the bags on an operational irrigation dam using equipment and resources available to a typical farmer. Test sections on the dam were monitored to determine the amount of wave erosion of both unprotected and protected slopes of the dam. Tensile strength tests were performed on samples of the fabric. The results of the strength tests indicate the durability of the system. Laboratory immersion tests were conducted on two soil materials used to fill the bags. The results of the immersion tests were then compared to the field performance of each material in the bags. The results of this investigation indicate that the system is readily installed on irrigation dams and offers excellent slope protection. The factors which influence the practicality of the system include the cost of alternate slope protection methods, the position of the irrigation dam in relation to local winds and the availability of fill material for the bags.
W80-05468

FUTURE PROSPECTS FOR GEOTHERMAL ENERGY,
For primary bibliographic entry see Field 6B.
W80-05660

8H. Rapid Excavation

GIANT HOLES ARE DRILLED IN NEVADA.
Drilling Contractors, Vol 36, No 4, p 30-36, April, 1980. 2 Fig.

Descriptors: *Rotary drilling, *Drill holes, *Drilling equipment, Nevada, Rock excavation.

Current big hole drilling at the Nevada Test Site is in the 4-ft. to 8-ft. diameter range. Drilling requires the use of a dual-string, air lift, reverse circulation system. Drilling weights of 300,000 pounds or more are made available through the use of cast, split-donut weights which can be made in any diameter and used in any quantity. A conductor hole is drilled 10 ft. deep. Corregated metal pipe is set in the hole and the annular space is backfilled. The surface hole is then drilled to 118 ft. and the surface casing set and cemented. Then the wellsite and pits are built. The rigs are oil wells rigs modified in the area of the rotary table supports so that an opening could be cleared enough to pass the larger donut weights and the drill bits. Rotary speeds are governed by the resulting rotational speeds of the gage cutters on the bit. Drilling torques are not excessive. Penetration rates are low at about 4.5 ft./hr. but average deviation per well is less than 0 degree-3 ft. of angles. The flat-bottom bit has replaceable stabilizer rollers and cutters available as mill tooth or with tungsten carbide inserts. Retipping of mill tooth cutters controls bit cutter costs. (Purdin-NWWA)
W80-05549

CORE DRILLS CAN BE IMPROVED,
Read Drilling and Development Corp., Washington, DC.
For primary bibliographic entry see Field 8C.
W80-05550

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

ARCHIVAL OF VOUCHER SPECIMENS OF BIOLOGICAL MATERIALS COLLECTED UNDER THE OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM (OCSEAP) SUPPORT,
California Academy of Sciences, San Francisco, CA.
W. N. Eschmeyer.
In: Environmental Assessment of the Alaskan Continental Shelf. Annual Reports of Principal Investigators for year ending March 1979. Vol X, Hazards, Data Management, p 512-517, October 1979. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Basic data collections, *Baseline studies, *Aquatic life, Pollution monitoring, Resources development, Alaska, Water pollution effects, Environmental effects, Storage and retrieval, *Outer Continental Shelf, Biological collections, Petroleum development.

The baseline data collected for the fauna and flora in the OCSEAP study area is based on extensive biological collections made by many separate research units. OCSEAP has established the California Academy of Sciences as a central respository for representative specimens from these collections. This will ensure that materials are permanently available for reference and for confirmation and upgrading of identifications made by research units. This document specifies the voucher policy, its applications, preservation procedures, labeling instructions, and information on shipment of specimens to the repository. Voucher specimen labels, prepared to meet NOAA's data needs, were printed on special label paper and distributed to principal investigators. The permanent voucher specimen collection and policy, including the identification policy for field personnel, are aimed at increasing the reliability of the data collected. (Sinha-OEIS)
W80-05603

10F. Preparation Of Reviews

A CATASTROPHE MODEL OF THE PALEOCLIMATE,
Maine Univ., Orono. Inst. for Quaternary Studies.
For primary bibliographic entry see Field 2C.
W80-05669

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*U.S. GOVERNMENT PRINTING OFFICE : 1980 O-311-059/4

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